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A. M. & J. FERGUSON,

COLOMBO, CEYLON

1910.

Photo by H. F. Macmillan.

STENOCARPUS SINUATUS.

FLOWERS BRIGHT SCARLET.

THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

VOL. XXXIV. COLOMBO, JANUARY 15TH, 1910. No. 1.

Review.

THE WEEDS, POISON PLANTS, AND NATURALIZED ALIENS OF VICTORIA.

BY A. J. EWART, D.SC., PH.D., F.L.S., assisted by J. R. TOVEY.
(PP. 100 AND 33 COLOURED PLATES, MELBOURNE, 1909).

A description in popular language accompanied by coloured plates of the weeds and deleterious plants of an agricultural country is one of the most useful works which could be put into the hands of farmers and planters. In Victoria such a volume is rendered specially necessary by the existence of legislative enactments enforcing penalties upon farmers who do not carry out the prescribed measures for the eradication of proclaimed pests. The coloured figures of these pests have already been published serially in the Journal of the Agricultural Department of Victoria. The plates and published descriptions are now collected into one volume which is rendered more complete by a full account of the properties and best modes of treatment of all the commoner weeds of the country, to which is added a complete list of all the naturalized aliens and introduced exotics. An introductory section of twelve closely printed pages deals in an able and interesting fashion with the factors which influence the spread of weeds and with the best methods for their suppression.

Space only allows of our selecting for quotation two brief passages which cannot be taken too seriously to heart by all planters and agriculturists of whatever country.

"No point is more important to the settler on forest land than that he should clear no more land at a time than he can keep clear and free from weeds. Any slackness in this respect soon reduces the land to a condition which, from the point of view of cultivation, is as bad as, or even worse than, when it was under forest."

And on page 7: "It is not too much to say that no new plant should be introduced into this State, and not even in a private garden, if there is any chance of its spreading, unless an official report of its capacities for good and evil has been obtained, and unless the report is a favourable one."

The descriptions of plants which occupy the bulk of the book are written in popular language, and the meanings of the few technical expressions used are explained in a short glossary. The author is to be congratulated on having produced an admirable model of what such a book should be.

R, H, L,

INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE AND COLONIAL DEVELOPMENT, BRUSSELS, 1910.

We have received from the Director of the Imperial Institute, London, an account of the preliminary proposals with regard to the British Section of the abovenamed Congress.

It appears that an International Congress of Tropical Agriculture and Colonial Development was held in Paris in 1905, and at the close of that Congress an International Association was founded, having for its principal object the Organisation of such Congresses in the future. It is proposed by the International Association to hold a second Congress at Brussels in May, 1910. The local arrangements at Brussels will be made in co-operation with the Belgian Association for the study of Tropical Agriculture. The International Botanical Congress will also meet at Brussels at the same time and will take part in the proceedings. Representatives have been appointed in Great Britain and its Colonies, Germany, France, Italy, Belgium, the United States and elsewhere, and local committees are in process of formation in those countries to make arrangements for the reading of papers and other matters.

The following is a schedule of the subjects proposed for discussion by the British Representatives at the Congress :—

1. RUBBER.

Utilisation of natural rubber resources. Acclimatisation of exotic rubber trees. Formation of rubber plantations. Methods of tapping. Composition of latices. Composition of raw rubber. Methods of preparing rubber. Storage and transport of rubber. Insect and fungoid pests affecting rubber trees. Economics of rubber production, etc.

2. COTTON.

Cultivation of exotic cottons in new countries. Improvement of native cottons. Breeding of more productive or pest-resistant varieties. Schemes for seed selection. Utilisation of bye-products. Organisation of ginning stations. Packing, transport and shipment of cotton. Methods of disinfecting cotton seed. Remedial measures against insect and fungoid pests of the cotton plant, etc.

3. TOBACCO.

Cultivation. Planting in new countries. Soils suitable for tobacco cultivation. Manures. Organisation of field experiments. Composition of tobacco. Methods of analysis. Fungoid and insect pests affecting the tobacco plant or stored tobacco. Economics of tobacco production. Varieties in demand in different consuming countries, etc.

4. WHEAT.

Methods of cultivation. Accounts of field experiments. Methods of manuring. Breeding of prolific and rust-resistant varieties. Analysis of wheat required by different markets. Methods and times of marketing. Transport and storage. Remedies against insect pests affecting stored wheat.

5. CANE-SUGAR.

Field experiments with sugar-canes. Selection of canes. Maintenance of rich varieties. Manuring of sugar-cane. Organisation and working of cane-sugar factories. Utilisation of bye-products, etc.

6. GENERAL AGRICULTURE.

Organisation of field experiments and demonstration plots. Improvement of native agriculture in the tropics. Rotations suitable for the tropics. Catch crops. Methods of manuring suitable for use by natives. Improvements in agricultural tools and machinery, etc.

7. FORESTRY.

Schemes for forest conservation. Working plans. Re-afforestation in the tropics. Timber and fuel supply. Utilisation of minor forest produce. Special forest products such as palm oil, oil seeds, tanning materials, gums, resins, turpentine, etc.

Sections (1) Rubber and (6) General Agriculture are those which most nearly affect the patrons of the *Tropical Agriculturist*, although the discussions on Cotton and Tobacco are likely to be followed with interest by a considerable section of readers. At the present stage of the Rubber industry the questions relating to that product may probably be relied upon to afford the subject of keen and valuable discussion. It is to be hoped that the problems of general native agriculture will meet with equally full attention, and that they will not be relegated to a secondary position owing to the competition of the more opulent industries.

R. H. L.

GUMS, RESINS, SAPS AND EXUDATIONS.

PROSPERITY AND RUBBER.

(From the *India Rubber World*, Vol. XL., No. 5, August 1, 1909.)

Our regular British correspondent on another page voices a suggestion which is apt to be heard whenever crude rubber prices are on a rising plane—that it may be due to "manipulation." This is an euphonious word, and its use is safe because the assertion involved cannot readily be proved or disproved. Besides, while the charge of "manipulation" may be meant to be uncomplimentary to somebody, it neither carries a criminal imputation nor is aimed at any one in particular. It is, therefore, harmless.

Usually a rise in rubber prices is attributed in Europe to influences on this side the Atlantic, and *vice versa*. But just where or how rubber prices are fixed has not yet become a simple question. Assuming that advances in rubber are due to speculative manipulation, how about the fall in prices which generally follows?

All buying and selling of commodities is more or less speculative, but what is criticised is the alleged control of the market by other influences than mere supply and demand. It is certain that much trading in crude rubber is of the class known as "short" sales, which involves an effort to depress prices. Most purely speculative effort in the rubber market is of this kind, instead of creating a "corner" in the supply and forcing consumers to pay exorbitant prices. Most attempts to corner rubber have resulted disastrously to the promoters, and if high prices have resulted a speedy "slump" has followed.

Whatever the cause of fluctuations in rubber, however, each succeeding slump has stopped a higher point than the one before, until it would now appear that the normal price of rubber is twice as high as twenty years ago, in spite of the greatly increased production meanwhile. Surely this general and long sustained advance—to say nothing of the earlier steady advance from 25 cents per pound—cannot be attributed to any purely speculative influences. The demand for rubber has grown steadily from the date of its first utilization, and continues to grow. Whatever may be the future capacity of the world to produce rubber, it is now below the world's needs for the material.

The automobile situation in America alone points to a vastly enlarged increase in the world's demand for rubber. During the recent year of depressed business there was no loss of activity in the automobile industry in the United States, but each year showed a larger production of vehicles. This year's output is larger than ever, while every indication points to a still greater rate of increase for 1910. The condition is near at hand when automobile tires alone will call for as much rubber as was consumed in the whole industry in the United States ten years ago—the date of the introduction of the automobile. The condition of the country as a whole is most satisfactory. The period of depression referred to did not leave the country poorer, but in many respects in a better condition, and there is reason to expect a more notable era of progress than has yet been witnessed. To note a single feature, the normal condition of agriculture in America is the ownership of the land by the men who till it—every farmer his own landlord—with such results that the farmers are becoming notably wealthy as a class; the typical farmer to-day is an automobile owner.

But the future of the rubber industry will not be concerned with automobiles alone. The commercial truck and the farmer's and villagers' buggy demand rubber tires. And all the other branches of the rubber industry show a steady rate of growth. While the sale of mechanical goods, footwear, and the like during a year or so past fell off in volume, the profits reported by the large manufacturers were no less than in former years, and the condition of the industry was never more promising than now. It is such conditions of prosperity in America—to say nothing of the rest of the world—that make rubber cost more—not the manipulation of a few traders buying and selling. They could not sell at current prices unless the world wanted rubber goods in larger volume year after year. Better consider, as affecting rubber prices, such factors as the "record" American corn crop this year, estimated at 3,000,000,000 bushels, and the sale of which will help to swell so many farmers' bank accounts.

PALO AMARILLO RUBBER.

(From the *Indian Trade Journal*, Vol. XV., No. 185, October 14, 1909.)

The Palo Amarillo tree was discovered a few years ago on the slopes of the Sierra Madre, and upon investigation it was found to be a botanically unknown species. It is known in Mexico under

a number of common names, such as palo amarillo, palo colorado, papelillo, and cucuracho, the first-mentioned name being generally used. It occurs in the dry semi-tropic zone on the slopes of Sierra Madre, at an elevation of 900 to 4,800 feet, generally being found above the oak zone, and frequently reaching as high as the pine zone of the mountains. It extends southwards from Durango to the southern part of Oaxaca, along the Pacific coast, growing on rather poor, rocky or sandy volcanic soil, and it often forms a part of the xerophytic plant formations that have established themselves on the dry mountain sides. The tree grows to a height of between twenty and thirty-four feet, with a trunk diameter of from seven to twelve inches. In the inner bark of the stem and its branches occur numerous latex-bearing vessels, containing a semi-liquid fluid of milky whiteness, which solidifies on contact with the air. Chemical examination of this latex shows that it contains from 7·3 to 15·7 per cent. of rubber, and from 19 per cent. upwards of resins. The United States Consul at the city of Mexico says that he has personally analysed seventeen latex samples from different parts of the trees, and from trees growing in different soils. The latex from the lower parts of the trunk contains the higher percentage of rubber, as is the case with all rubber-producing trees. The branches carry a latex containing mainly resins, the rubber being about 3 to 6 per cent. and occurring in a form which makes it very difficult to be separated from impurities. The coagulation of the latex is not easy, although it can be accomplished. The resulting rubber is of inferior quality and would commercially be classed with Guayule rubber, which, it is stated, has commanded a price of about one shilling and threepence, whereas the price of first-class wild Para rubber was 3s. and 9d. per pound during the last year when rubber prices were low. It may be noted that rubber made according to modern methods from the ordinary Mexican rubber tree--*Castilloa elastica*--has reached the highest standard of Para rubber and has realised the same price. The product of the palo amarillo tree being new, the test of time, which after all is the most important one, has not yet been applied, but taking into consideration the low tensile strength, the large percentage of resins, and the rapid deterioration of the latex through enzymes, it is not very likely that palo amarillo rubber will show a better result than the rubber obtained from the guayule shrub. The rubber is easy to vulcanise by the ordinary methods. The exploitation of the latex of palo amarillo is beset with considerable difficulties. The Consul states that he has tapped these trees in all the different manners generally employed in tapping Hevea, Manihot, Castilloa, Funtumia, Ficus, or Sapium trees, and he has used over twenty of the different tools and implements, patented and employed in the rubber fields in Brazil, Central America and Africa, and he says that the proper method of tapping palo amarillo is not easy to determine. It is claimed that the palo amarillo tree is very easily propagated. A young branch cut from a growing tree and planted in the ground will grow. Commercially this does not mean much as the exploitable age of a palo amarillo tree must be at least ten or eleven years. A tree of this age does not give a very large amount of latex. The ordinary Mexican rubber tree, *Castilloa elastica*, can be exploited when eight years old, and it then gives a larger yield of latex per annum than a ten year old palo amarillo tree. Considering that the latex of the former contains from 25 to 47 per cent. of pure rubber, against about 8 per cent. in the palo amarillo latex, it is difficult to see the advantages of the latter under cultivation.

THE CULTIVATION AND PREPARATION OF PARA RUBBER.*

(From the *Gardeners' Chronicle*, Vol. XLVI., No. 1192, October, 1909.)

To Mr. W. H. Johnson belongs the distinction of having, some four years ago, written the first treatise devoted exclusively to Rubber. As might have been expected, when the rapid growth of the rubber industry and the excellence of Mr. Johnson's text-book were considered, the first edition was soon exhausted.

The present, second, edition has been thoroughly revised and extended to include a wider range of information. The statistics relating to rubber afford the raw material for a striking chapter in the romance of modern industry. From 1770, when Priestly recommended its use for erasing lead-pencil marks, till the twenties of last century, when Macintosh began to manufacture waterproofs, the use of rubber was remarkably limited. The extension of its employment dates from 1836, when Thomas Hancock discovered that crude rubber,

* The Cultivation and Preparation of Para Rubber, by W. H. Johnson, F.L.S. (London: Crosby, Lockwood & Son.) 7s. 6d.

cut up, pressed and heated, could be moulded into almost any shape, and when, in 1874, the method of vulcanising rubber by heating and treating it with sulphur was discovered.

From that date the imports of rubber into this country have increased enormously, and on the whole steadily, from about 150,000 cwts. in 1874 to 194,000 in 1886, 430,000 in 1896, and 600,000 in 1906.

It is a remarkable fact that, of the rubber consumed throughout the world in 1906, almost one-half was derived from rubber imported into this country. It is also noteworthy that more than half of the rubber used is Para rubber, that is, material derived from the latex of species of hevea, and chiefly from that of *H. brasiliensis.* Now that so much capital and industry are being put into the cultivation of rubber-producing trees, it is interesting to note the attempts to produce rubber synthetically. Already various "rubber substitutes" manufactured from the seeds of Poppy, Rape, Flax, &c,, are in use for mixing with crude rubber for special manufactures; but, so far, all attempts at the artificial manufacture of the genuine article have failed. He would be a rash man, however, and one ignorant of the wonderful fertility of resource of organic chemistry who predicts that synthetic rubber is an impossibility. The main reason why its manufacture is likely to prove difficult lies in the fact that rubber is not a single substance, but a mixture of complex compounds such as proteins, resins and caoutchouc. The significance to the tree of the latex from which crude rubber is prepared is doubtful. Most authorities regard it as a waste product of vegetable metabolism; but the author, having regard to its widespread distribution of plants, is inclined to think that it plays some part, albeit a small part, in the economy of plants. Mr. Johnson has given a most comprehensive account of the various processes connected with cultivation and preparation of rubber, and brings out incidentally the prominent part—on which we have more than once insisted in these pages—played by British Colonies, particularly by Ceylon and Malaya, in introducing rubber plants for cultivation.

From his estimates of cost it would appear that the cultivation of rubber is an extraordinarily profitable industry; but as to whether at the present prices of rubber shares it is a profitable investment the author is properly silent.

In conclusion, we would say that Mr. Johnson has written an admirable book, interesting not only to the expert but also to the layman who takes an intelligent interest in the progress of agriculture and of commerce.

A DEVICE FOR MEASURING THE GIRTH OF RUBBER TREES AND TAKING A CENSUS.

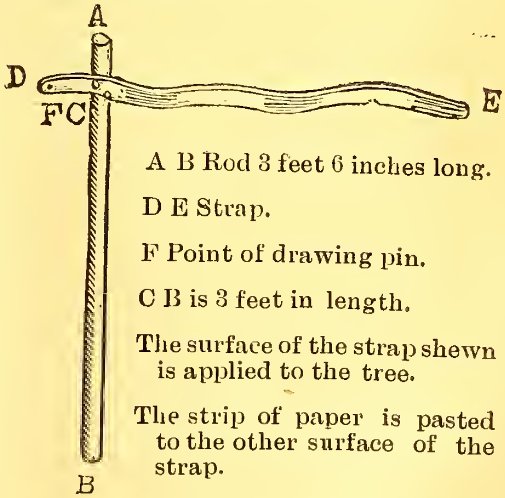
BY P. J. BURGESS.

(From the *India Rubber Journal*, Vol. XXXVIII., No. 8, October 18th, 1909.)

With the large number of young rubber plantations now approaching the tapping stage, positive information of the number of trees classified according to their girths is necessary both on the plantation and in the board room. To obtain this information by measuring with a tape and writing down the result, is slow and expensive in labour, and, in addition, requires skill labour, in that the coolies must be able to read figures and write them correctly, and there is a lot of further clerical labour wanted for sorting out the mass of results obtained.

The device I am going to describe was made to overcome these difficulties, and it was entirely a success in practice. The apparatus wanted can be made by any one; it is figured below. Take a rod 3 ft. 6 in. long, and 6 in. from the end fix a leather strap so that three or four inches project, and into this projecting end fix a drawing pin.

The strap should be about an inch wide and not too thick. On the surface of the strap fixed to the rod, paste a strip of white paper and the instrument is ready to use.



A B Rod 3 feet 6 inches long.

D E Strap.

F Point of drawing pin.

C B is 3 feet in length.

The surface of the strap shewn is applied to the tree.

The strip of paper is pasted to the other surface of the strap.

To use it, stand the rod upright against the tree, wrap the strap round the tree, the paper-coated side will be away from

the bark of the tree, make a prick in the paper with the point of the drawing pin where the short projecting end overlaps. This registers the girth of the tree on the strap.

The tree is then marked with a cross with a piece of chalk to show it has been measured, pass on to the next tree and repeat.

At the end of the day the strap is handed over to the superintendent, who rules off the pricked-marked paper into inches measuring from the point of the pin. The number of pricks in each inch is counted and recorded which, of course, is the number of trees of that girth measured in the day.

In this way one coolie on a clean estate can easily measure a thousand trees a day. To allow for the thickness of the strap the superintendent may make a few control measurements with a tape, but as a general rule half an inch is ample, and this is allowed for by measuring off the strap, not from the actual point of the pin, but half an inch inside it.

There is in practice no real difficulty with more than one prick being made in the same place, and the census taken in this fashion is accurate to three per cent., which is as much as is, in reason, ever wanted.

The advantages are, it is quick, it does not need skilled labour, it is simple, it automatically sorts out the results into the form required, namely, numbers of trees of specific girths.

OILS AND FATS.

THE CULTURE OF YLANG-YLANG.*

(From the *Philippine Agricutural Review*, Vol. II., No. 9, September, 1909.)

DEVELOPMENT IN REUNION AND COCIN CHINA.

Our readers may have noted in the last statistical tables of our valued collaborator, Mr. G. Ernst, that Réunion has now won recognition among the Ylang-ylang-producing countries. The distillers of Manila and Java will have henceforth to reckon with this new source of supply, for it is now an established fact that this tree prospers remarkably in the lowlands of Réunion and furnishes, in economic quantities, an essence equal to the best quality obtained in the Philippines.

MARKET CONDITIONS.

In order to reply in the most adequate manner to the inquiries that have been addressed to us regarding the present market conditions of the essence of ylang-ylang, we have sought information from the most competent industrial and commercial experts. First, Mr. Roure-Bertrand Fils, the able manager of the important firm at Grasse, France, gives, in a letter dated May 14, 1908, the following opinion :—

"Considerable quantities are beginning to arrive in the different markets from Réunion. We have had occasion to examine samples to the value of 450 or 500 francs, and in our opinion this essence is at least equal, if not superior, to that furnished by the Philippines, to which it bids fair to become a formidable rival. The shipments being made by post, it is very difficult to ascertain the figures regarding the importation into Europe."

With equal courtesy, Messrs. Schimmel & Co., of Miltitz, France, to whom we frequently apply for reliable information, have communicated with us as follows :—

"It is certain that the ylang-ylang met with in commerce is distilled principally in the Philippines* and in Java, and other countries are scarcely heard of in this connection. The present value of the very finest quality is about 5,000 francs per kilogram, while the medium quality scarcely exceeds 300 francs. The present production largely suffices for the demand, more especially since many perfumers and soap manufacturers prefer our synthetic essence of ylang-ylang, which is finer and more marketable.†"

In a more recent letter (May 30, 1908), Messrs. Schimmel call our attention to a passage in the Diplomatic and Consular Reports (No. 3973, April, 1908), which we here reproduce :—

* Translated from Journal d'Agriculture Tropicale, June, 1908.

* The value of the exports of this product were $15,930 in 1900, $46,296 in 1901, $63,270 in 1902, and $123,182 in 1903.

† This artificial product has already been discussed in No. 17 of the Journal d'Agriculture Tropicale, where it was seen that its influence on the market price of the natural product has not been very great.

"Two hundred liters of essence have been sold by Réunion dealers at an average price of 500 francs per litre. Many new plantations of ylang-ylang have been set out, and it is estimated that in three or four years the production will increase to 400 or 500 litres per year. The planters undoubtedly realize a very good profit at present, but it is to be feared that, as in the case of vanilla, an overproduction will lead to a fall in price."

PRODUCTION OF DIFFERENT COUNTRIES.

We find in the Bulletin Commercial of Réunion that the total exportation of essence amounts at the present time to only 279 kilograms. The importance and the value of the ylang-ylang cultivation in Réunion being thus established, we shall discuss what has been undertaken in other places.

In Jamaica there was an attempt, without very conclusive results, to distill the flowers of the trees which were cultivated in Hope Gardens. The details of this experiment, which does not seem to have been repeated since then, may be found in No. 52 of the Journal d'Agriculture Tropicale, 1905.

In Indo-China ylang-ylang is widely cultivated as an ornamental tree, but up to the present it does not seem to have been exploited for its perfume. Some cultural enterprises in Cochin China have been noted in a United States consular report (April, 1908), in which we read :—

The plantation of ylang-ylang lies in the Province of Bienhoa, where the first results are encouraging. The present high price of the essence renders this culture very remunerative. It is estimated by the planters that a hectare planted with 600 trees will produce 9,500 kilos of flowers, which when distilled will furnish at least 16 kilos of essence.*

In India attention has been drawn to ylang-ylang by the exhibition, at Kuaal Kangsar, of a sample of essence from the estate of Pula Daat, in Labuan. It was after a long sojourn in the Philippines that the director of Pula Daat undertook the extensive cultivation of this plant. He hopes this year to distill a considerable quantity for market. (Supplement to the *Tropical Agriculturist*, September, 1907.)

We have thus found that ylang-ylang is cultivated under excellent economic conditions in Réunion, and that the area planted to it is extending rapidly there as well as in Cochin China and British India.

THE CULTIVATION.

Useful information regarding the culture of this plant will be found in No. 17 of the *Journal d'Agriculture Tropicale*, and more recent documents enable us to add to this, now that the subject is again attracting attention.

Botany.—The botanical species which furnishes the essence of ylang-ylang is *Cananga odorata*, Hook F. and Thoms, more or less widely distributed throughout southern Asia. It appears that it is incorrect to distinguish, as is often done, between this species and *Unona odorata*, Dun., which is identical with it. *Unona odoratissima*, Steud, on the other hand, is the same as *Artabotrys odoratissimus*, R. Br., a species that differs absolutely from *Cananga*, both in its general characteristics and the inferiority of its product. It is important in cultivation to plant *Cananga odorata*, which is easily distinguished from *Artabotrys* by its distichous arrangement and more herbaceous appearance, recalling by these characteristics "anone cœur-de-bœuf" (*Anona reticulata*), and finally by its large flowers which grow only in groups of two or three.

In the specimens of this plant at the museum, examined by the late L. Pierre, a botanist whose work the *Journal d'Agriculture* has published, the identification is absolute between *Cananga odorata* and *Unona odorata*. If there exists a difference in the value of the essence produced, as Mr. Guerlain, the great Parisian perfumer, has indicated to us, it can only be attributed to physiological differences.

The culture of *Cananga odorata* in Réunion has been described explicitly by Mr. Martin de Flacourt in an article published by the *Journal Officiel de Madagascar*, March 19, 1904. According to this author the tree had been grown in Madagascar a long time, when a planter of Saint Paul decided to submit some flowers for distillation, and the excellent quality of the essence was revealed. This was the beginning of methodical cultivation.

Climate.—Ylang-ylang requires a warm and even climate, soil that is rich, permeable, and healthy, and in Réunion it will not flower at an altitude of more than 400 metres.

Methods of reproduction.—The plant multiplies by means of seeds, which may either be planted directly in place, or

* Mr. Martin de Flacourt estimates that in Réunion 1 hectare planted in ylang-ylang will yield about 4 kilograms of essence. (N. d. l. R.)

in well-drained seed boxes and later transplanted. The seeds are taken from the fruit when it is perfectly ripe, and washed to free them from the sugary pulp which would attract ants and result in irregularities in germination. The plants sprout in from forty to sixty days, being sprinkled twice a day. After the plants are a month old they are transplanted into a shaded nursery and spaced at 20 centimeters, or, as is preferable, placed separately in cornucopias made of the leaves of *Pandanas utilis* to serve as flowerpots, or in bamboo pots which are protected by shelters made of palm leaves. The sprinklings are continued as before, and in two months the young trees are 25 or 30 centimeteres high, and worth 40 francs per thousand, pots included.

Planting.—The permanent planting is made on clean ground, the trees are placed 4 or 5 meters apart, in holes 50 centimeters in diameter three-quarters filled with vegetable mold or manure and good earth. By following this scheme of planting five or six hundred trees can be planted to a hectare.

During the first years it will be found necessary to keep the soil clean between the trees. The crops that can be raised in this way will more than pay for the trouble. In order to encourage the growth of the lateral branches, and by this means produce flowers that are more accessible, the trees are topped at a height of 2½ or 3 meters.

In the third year there may be a crop of flowers that will bring 150 or 500 francs per hectare. This return will increase rapidly, and the period of full bearing will last eight or ten years.

GATHERING THE FLOWERS.

In Réunion the harvest lasts from May to September. The work is done by women and children, who are careful to detach only full-blown flowers, and those of a clear yellow colour. At the height of the flowering season the trees are gone over every two or three days, and the process of distillation can go on almost without interruption. Fresh flowers give the best essence.

Under these conditions, says M. Martin de Flacourt, 1 hectare regularly planted should furnish 3 or 4 kilograms of essence per year, estimating that from 50 to 64 kilograms of fresh flowers will yield 1 kilogram of essence. The cost of distilling varies with the country, depending upon the equipment in use, the price of labour, and the cost of fuel. The price, fixed at 22 to 30 francs per kilogram of essence for Réunion, rises to 20 francs per pound in the Philippines, and 4 francs 65 centimes per ounce in Jamaica.

In Manila, the distillers, who are all Germans, buy the flowers from the native inhabitants at the rate of from 1 franc to 1 franc 50 centimes per pound. The picking is brought in the morning in order to subject the flowers to the vapour as early in the day as possible. In the period from July to December the trees furnish the best product, often averaging 100 pounds of flowers to the tree. It requires from 80 to 200 pounds of flowers to make one pound of essence.

Under present market conditions the raising of ylang-ylang of a superior quality would be remunerative, even though the yield might not exceed 3 or 4 kilograms per hectare. But it would be necessary to consider, before setting out new plantations, that the product is one for which the market is rather limited, that the synthetic essence is to be reckoned with, and that there are many young plantations that are coming on to increase the present supply of the market. These facts demand serious consideration, especially when it is a question of undertaking the culture on a large scale.

SOME NOTES ON VARIOUS OIL AND FIBRE-PRODUCING PLANTS.

BY S. H. BOYLE.

(From the *Transvaal Agricultural Journal*, Vol. VIII., October, 1909, No. 29.)

Having been engaged recently in investigating the conditions governing the production of oil seeds in the Transvaal, with the object of discovering the chances of success which an oil factory would meet with, the following notes may prove to be of some interest to agriculturists in the Transvaal. These investigations were instituted with the idea of finding out to what extent oil seeds were grown at the present time; whether the results so far had been satisfactory, and what varieties of seed seemed to be most profitably grown, while methods of cultivation, value of by-products, and other kindred questions were not omitted. The existing soap and candle factories provide a market for oil seeds of certain sorts; and this market is likely to be largely increased by the establishment in South Africa of branches of other great manufacturing firms. The farmer will thus probably benefit by being able to obtain better prices than heretofore, on ac-

count of the competition which must inevitably ensue.

The principal oil seeds grown in the Transvaal at present are peanuts, castor beans, sunflower seed, and cotton seed, but there are others well worth attention.

Dealing with those in the order named we find that peanuts have been grown extensively, and if prices prove remunerative, will be grown on a larger scale. There is a great deal of light soil well adapted to this crop; but the trouble has been in the harvesting—the cost of labour eating up nearly the whole profit. With improved implements this will be avoided to a great extent, and the "Rice" peanut harvester, now under trial, may solve this difficulty. Another solution to be found is the choice of variety, and reports have reached me from many districts that the Viriginian "Bunching" variety gives less trouble than any other.

Another trouble has been that, although the plants grow well and produce pods plentifully, many of the pods are empty. This may be accounted for by the abnormally wet season, fertilisation being interfered with. It is not proved yet whether the plants are self-polinated or not, and undoubtedly the drenching rains would have a disastrous effect in the latter case. Peanuts should be marketed clean and dry, and, if possible, without the pod. Before expressing oil, the seed have to be cleaned of the inner skin, which would impart a bitter flavour. Any process which can be easily and cheaply performed on the farm to prepare seeds for crushing will, naturally, result in a higher price being obtained from the manufacturer, and the initial outlay on a small dessicating machine will soon be covered by the enhanced value of the product.

Castor beans have not so far won a high opinion from the farmer as affording a profitable crop. This is probably due to the fact that the wrong variety has been planted and by a wrong method. In India and United States the *only* profitable form of cultivation has been found to be that in which the plant is treated as an annual, and the maximum number of plants grown to the acre. In the United States the best results are obtained by planting 18 inches apart in rows 4 feet asunder. In India the plants are generally employed as a shade to the young rice plants and pulled up as soon as the seed is ripe. This method of treatment could only be employed where there is a long growing season free from frost. The variety which under these circumstances gives the largest yield is the small-seeded one; and the seeds of this variety also yield a higher percentage of oil. The whole of the plants, with the exception of seed, should be ploughed in as manure, and the waste from the oil factory also affords a manure rich in potash.

Castor oil plants require feeding, and will not yield good harvests if starved—in which they resemble most other plants. They should therefore only be grown as rotation crops, and follow mealies with good results.

Sunflowers appear to be growing in favour. The cultivation is simple and the returns good. In wet summers there are likely to be numerous empty fruits, this may deter some from making a second experiment. Sunflower seed oil is of great value as a basis of fine soaps, especially shaving soap, and for mixing the finer and lighter shades of paint. For the latter purpose it is considered superior to linseed oil, as it does not dry yellow. The Russian variety which has been introduced by the Department of Agriculture gives the largest returns. The oil is also largely used for food purposes.

Cotton seed is now been grown extensively in the lowcountry. It is only in the warmer parts of the Transvaal that good results can be expected of this crop. The seed gives a certain amount of trouble in its preparation for oil manufacture, owing to fluff remaining on the seeds after ginning. Several processes are necessary before it can be extracted. But the whole seeds furnishes such a number of products that the labour is rewarded. Linters as the fluff is termed, and husks, or "hulls," furnish material for paper; the hulls are an excellent substitute for bran, and can be utilised for fuel and the ash for fertiliser. The kernels, after giving up their oil, form a most nutritious food for live stock of all kinds, and also are a valuable fertiliser.

Cotton seed has one drawback—it cannot be stored in bulk for any length of time, owing to its capacity for heating. Heating destroys its qualities for all purposes but that of manure. Therefore cotton seed should be marketed immediately after ginning, and should be treated for oil as soon after its arrival at the mill as is possible. For this reason cotton oil mills are usually found close to the cotton plantations, easily accessible to the producers, and in fact are in some cases an adjunct of the ginnery.

In addition to the abovementioned seeds there are several worth attention,

one of which is already grown in the Transvaal, but not for oil. The soy bean yields 18 per cent. oil of fine quality, and is attracting the attention of oil manufacturers in Europe. This plant is well known as a forage and green soiling crop, and it is only to the additional source of profit in the bean itself that I would turn the attention of the farmer. The "cake" has a high value for feeding purposes, as is the case with all "oil cakes," except castor oil cake, which is extremely poisonous.

Another of the seeds worth attention is linseed, the oil from which is well known and for which the demand always exceed the supply. Linseed meal and cake are also highly esteemed by stock raisers, and it is satisfactory to know that there are many farmers who realise the value of these concentrated foods; and who would readily purchase them, if they could be produced locally at a moderate price. I have heard it said by dairymen that they should be obliged to charge more for their milk if they fed their cows on oil cake; quite forgetting that well-fed cows would give more, and better, milk. A large increase in cultivation of oil seeds would have a far-reaching effect if it made it possible for a local oil factory to turn out oil cake at, say, £5 per ton. There is, however, another aspect to the question. Oil cake is not the only by-product of oil seeds. The cotton seed is merely a by-product of the cotton fibre, but in the case of sunflowers and linseed the fibre may be considered as a by-product of the seed.

The fibre of the sunflower is almost as fine and strong as silk, and the greater proportion of Chinese and Japanese silks are largely adulterated with this fibre. The clean fibre is worth upwards of £20 per ton, and the preparation involves little expense. The same may be said of flax. In both cases ratting may be postponed until the work of harvesting is at an end, and the *scutching* can be performed at any slack time. In the case of sunflower fibre a few natives—children—could do all that is required, while flax requires rather more elaborate arrangements. The cultivation calls for no special notice. Sunflowers require much the same treatment as mealies, both in preparation of the soil and in after-cultivation.

Linseed or flax does best in newly-broken soil, or soil that has been fallowed; and for fibre should be sown thickly, to prevent branching, and by drawing up the plants to produce longer fibres. For seed production thinner sowing is advisable. Usually the plants are grown to produce both seed and fibre, and although better results of one kind might be obtained by growing for seed, or for fibre only, the difference is hardly so great as to compensate for the loss of the other product, and in practice is rarely done in the flax-producing countries of Europe.

Hemp is another fibre-plant that should succeed in deep and fairly moist soils. The fibre of hemp is unsurpassed for ropes—it is stronger than manilla, and has twisting qualities unequalled by any other fibre. The plant attains large dimensions, which vary with soil and climate. The usual height is from 8 to 12 feet, though in China 17 feet is obtained. Every foot in length gives 150 lbs. of fibre to the acre. One-and-a-half bushels of seed are usually sown to the acre. The seed yields an oil of no great value, and the cake is too purgative for general use as a cattle food.

In conclusion, I would urge farmers to endeavour to attract a market by growing marketable oil seed. 33,000,000 tons of peanuts are annually exported from Madras to Marseilles. Soy beans are being shipped from Manchuria to the European ports. There is already an oil, soap, and candle factory in the Transvaal, and every prospect of further undertakings of this nature. It should be quite possible in the near future to establish a cotton spinning industry.

There is great talk just now of supporting local industries—a very patriotic sentiment. It may not be forgotten, however, that the producer has the same duty to his country as the consumer, and his business should be to produce articles for which there is a local demand, and of such quality as will attract the consumer. The man of limited income must necessarilly buy in the cheapest market—that is to say, get the *best value* for his money. It should be the aim of the South African producer to supply the best quality at the most moderate price possible.

FIBRES.

BAGASSE FOR PAPER.

BY WILLIAM RAITT,
Chemical Engineer and Fibre Expert, Bangalore.

Bagasse or megass, the refuse crushed sugar canes or chips from the diffusion batteries, has come into some degree of prominence of late as a possible raw material for paper. It may therefore be useful to consider, from the collective experience available, modified or confirmed by our own, how far the hopes held out regarding it in some quarters are likely to be justified. The growing scarcity of wood-pulp in Europe and America is giving occasion for a great amount of research and experiment with the object of finding a suitable substitute, and while several have been suggested which combine all the advantages necessary to a commercial as well as a technical success, it is to be feared that an insufficient acquaintance with the scientific and economic problems evolved, has resulted in others being brought forward which hold out very little prospect of practical usefulness.

It may be as well, first, to enquire as to what grade or class of raw material is wanted in supplement of, or in substitution for wood-pulp. For this purpose, paper may be broadly divided into three main grades, corresponding fairly accurately with the principal divisions of the raw material market:—

(1.) The best qualities of writing paper,—manufactured almost wholly from linen and cotton rag.

(2.) Inferior writing paper, book printing and news paper,—manufactured mainly from wood-pulp.

(3.) Coarse unbleached paper, wrapping and packing paper,—manufactured from textile wastes, old sacking and such like materials.

Now, the growing demand for a new material arises solely from No. 2, since rag is now reserved almost exclusively for No. 1, the supply is quite adequate to the demand, and, apart from this, no other material is likely to be found which, at the same cost, combines the necessary requirements of strength and colour. For No. 3 where strength only is required, the market is also fully supplied, and the steady development of textile industries, with the resultant continual increase in the output of wastes, seems likely to keep it so. But although the new demand is confined to No. 2, it represents about 75 % of the whole, and at present uses up about six million tons per annum, so that there is plenty of scope for a material suitable for it. In this case, suitability means that it be bleachable at a low cost.

Bagasse contains about 50 % of available cellulose. Our own investigations of it have yielded from 46 to 50 %, and with a comparatively mild soda treatment it could be depended on to give, in mill practice, an average yield of 45 % of air dry unbleached cellulose or pulp. So far, it appears to fill the bill, but there is more than that which goes to the making of a good pulp for No. 2 class.

With all fibre-yielding plants, there is a point or period of growth at which the fibre is at its best, not only in quantity and quality, but (what is of serious importance to the paper-maker) in uniformity of its qualities throughout the whole plant. The pulp to be produced must be of uniform quality, and this cannot be got if there are serious differences in the nature of the raw material as between one part and another of the plant. With plants grown primarily for fibre, a period can generally be fixed on for cutting at which the fibre is at its best, not only in strength and colour, but also in uniformity throughout the whole plant. But with cultivation primarily for other uses, the case is very different. Generally, when fibre only is wanted, the plant is at its best when fully mature *but not ripe.* Where fruit or seed is the chief object the mature stage of the fibre is passsd; where *juice* is wanted, it has not been reached.

The stage at which sugarcane holds its maximum saccharine contents appears to coincide with a state of partial and irregular maturity of the fibre. While the fibres on the outside, or just under the skin of the cane are firm, long and good, of strength though somewhat harsh, those from the interior are short and weak. It therefore presents the most difficult of problems to the paper-maker. Since the chemical treatment must be uniform, it follows that it must be severe enough to reduce the outer fibres completely, thereby largely destroying the inner ones, or it must be mild enough to conserve the latter and leave the former only partially resolved into pulp. In the first case the yield is largely reduced, and what remains is expensive to bleach because

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the severity of the treatment has degraded the weaker fibres into insoluble brown compounds which stain the pulp. In the latter case, the yield is good, but the product is almost equally difficult to bleach satisfactorily because of the admixture of partially digested outer fibre. The pulp is consequently full of specks and blotches, unfit for anything but the commonest of bleached paper, and that only in conjunction with some better and more uniform material.

This feature of bagasse explains the wild differences in yield reported by various experimenters,—those using the severe treatment getting as low as 25 %. Our own preference is for the method which gives the largest yield irrespective of bleaching qualities, since by neither process is the bleaching satisfactory either in efficiency or cost. This opinion is reinforced by the fact that the larger yield is obtainable at a lesser cost for soda, and, further, by the technical difficulties and cost of bleaching in the tropics with imported chemicals. It must, however, be conceded that in no department of chemical technology is progress more hopeful than in this, and it is quite possible that we may see a considerable improvement in bleaching processes during the next few years.

We do not think, then, that bagasse can be seriously considered as a candidate for class 2, but there are localities in which it may find a very profitable entrance into class 3.

Cane sugar factories are usually situated in localties where all manufactured goods have to be imported at a considerable cost for freight, and, probably, import duties also. Where such circumstances exist together with a sufficient local demand for unbleached wrapping and packing papers, or even for the thin unbleached paper so largely used by the natives of India and elsewhere for correspondence and accounts, it is quite possible to show that a paper-mill may prove a very profitable auxiliary to a sugar factory, and that the bagasse may be worth considerably more for this purpose than its present fuel value.

A paper-mill suitable for this class of paper, to produce 40 to 50 tons per week, would cost roughly £20,000. A conservative estimate of the cost of production, under average conditions, exclusive of the fuel value of the bagasse but including repairs, depreciation and 5 % interest on cost of plant, amounts to £10 10s. per ton. Under the conditions above referred to the product should be worth £15, leaving £4 10s. as the paper-making value of the 2¼ tons of bagasse required to produce it, or say £2 per ton. The cost of steam coal to replace it in the sugar factory furnaces would be at the outside £1 10s. per ton. In calorific effect a ton of good steam coal is usually assumed to be equal to 4 tons of bagasse, so that the full value of the latter cannot exceed seven shillings and six pence per ton. Deducting this, there remains an estimated profit of £1 12s. 6d. per ton of bagasse converted into paper.

CHANGES IN EGYPTIAN COTTON WHEN GROWN IN THE UNITED STATES.

(From the *Agricultural News*, Vol. VIII., No. 194, October 2, 1909.)

In Bulletin No. 156 of the Bureau of Plant Industry, United States Department of Agriculture, the following conclusions are arrived at in connection with the diversity which arises in Egyptian cotton when it is introduced into that country:—

The diversity found in the Egyptian cotton in Arizona appears to be of four different kinds, evidently arising from different physiological factors. Precautions which may tend to avoid one kind of diversity will not be fully effective unless other factors are taken into account at the same time. Methods of acclimatization, breeding, and culture have all to be adapted to the special needs of the case, if the full possibilities of the new crops are to be definitely ascertained.

The first and most striking of diversity is due to hybridization. The cross-fertilizing insects are much more abundant in the south-western States than in any other cotton-growing region thus far investigated. This will render it impossible to maintain a culture of pure Egyptian or other high grade cotton, unless all other kinds of cotton are excluded from the localities in which superior stocks are planted. Though the lint of the hybrid plants is often superior to that of the pure Egyptian plants, it is sufficiently different to interfere with the commercial uniformity of the product.

The second kind of diversity that affects the Egyptian cotton is evidently due to incomplete acclimatization. As with other types of cotton, transfer to new conditions induces great variation, not only in the habits of growth and other vegetative characters of the plants, but also in fertility, and in the abundance and length of the lint. This form of diversity is to be eliminated by the

selection, each year, of the plants that approach most nearly to the normal form of the variety, are the most fertile, and have the best lint.

The third kind of diversity is more directly connected with differences in the physical environment which cause, or call forth, differences in the individual plants. It is shown most strikingly in comparing the behaviour of the plants in the different localities, but includes also some of the differences that occur in the same locality or in different parts of the same field. This form of diversity is familiar in all branches of agriculture but is greater with a newly-introduced variety, and may be expected to decrease as a better adjustment to the new conditions is attained. The second kind of diversity represents incomplete acclimatization, while the third kind is more closely connected with the phenomenon of accommodation.

The fourth kind of diversity is shown in the different parts of the same plant, and is often very pronounced, especially in the characters of the lint. If the plants become too luxuriant, fruiting is deferred until late in the season, or the early bolls remain poorly developed and produce a very weak fibre. To avoid this form of diversity, a proper relation has to be established between the habits of growth of the plants and the methods of culture and irrigation. Sudden changes in the rate of growth are particularly to be avoided, as tending to produce fluctuations in the fertility of the plants and in the commercial quality of the lint.

The principal reason why diversity has such serious effects upon the yield of lint is found in the habit of the cotton plant to produce two types of branches, which are quite distinct in form and function. Slight differences of external conditions which might have very little direct effect upon the size and vigour of the plant are able to induce relatively great differences in the yield by inducing a preponderance of the sterile, vegetative form of branches over the fertile form.

OBSERVATIONS ON THE EFFECTS OF STORAGE ON COTTON SEED.

By H. A. TEMPANY, B.SC. (LONDON), F.I.C., F.C.S.
Acting Government Analytical Chemist, and Superintendent of Agriculture for the Leeward Islands.

(From the *West Indian Bulletin*, Vol. X, No. 2, 1909.)

Cotton seed at the present time is a product of considerable value in the West Indies, both from the point of view of growth of the cotton crops and also on account of its usefulness as a stock feed, and as an oil crop. On this account the changes which it is likely to undergo as a result of keeping are matters of importance.

It frequently happens that cotton seed may, for various reasons, be stored for considerable periods of time before it can be used, and observations are here brought forward which throw some light on a few of the effects likely to be induced by storing.

Such effects fall naturally under two heads: (*a*) Effects on the actual chemical composition of the seed; (*b*) Effects on the vitality or germinating power of the seed; and the results given below are grouped accordingly.

(*A.*) *Effects of Storage on Chemical Composition of the Seed.*

When crushed cotton seed is mixed with water, the resulting mash is usually of a bright yellow colour. In February, 1908, a sample of crushed cotton seed was received at the Government Laboratory from the Leeward Islands, which, when mixed with water in this way, was found to give a bright green colour, instead of the usual yellow tint.

At first sight it was thought that this peculiarity was due to the admixture with the sample of some inorganic mineral substance, such as Paris green, either by accident or intentionally; chemical examination, however, soon showed that this idea was erroneous, and that the green colouration was more probably due to some organic substance derived from the seed itself. When the crushed seed was examined under the microscope, it was found that it contained numerous opaque masses, which broke down in glycerine and water to small round green bodies.

Enquiry elicited the fact that the seed in question was of considerable age, having been grown in 1906 and kept until 1908, before crushing. It therefore appeared likely that the development of the green colour might be due to changes which had taken place in the seed as a result of long keeping, and this supposition was subsequently verified, investigation making it clear that the observed appearances were due to changes in the resin masses.

If a cotton seed is cut across, the cotyledons are seen to be marked with a large number of dots; these are the resin masses mentioned above. According to Hanausek, 'the secretion contained in them is olive-green, flowing out

of the cavities in the form a yellow-green emulsion, the particles of which are in lively motion. Strong sulphuric acid dissolved the secretion to a beautiful blood-red solution'.* A sample of freshly grown cotton seed was examined under the microscope in the laboratory in February, 1908, when it was found that the secretion in the resin cavities appeared clear brown instead of olive-green, as stated above. Treatment with sulphuric acid gave a very beautiful crimson solution. On the other hand, when a sample of seed which had been kept in the laboratory for some years was examined, it was found that the contents of the resin cavities were olive-green, as described above. Treatment with sulphuric acid resulted in the formation of a blood-red colouration as stated, but less intense in colour than with new seed.

From these observations it appears that the contents of the resin cavities undergo change on keeping, either by oxidation or other means, whereby they are changed from a clear brown to a dark green.

This was subsequently verified by examining, after a lapse of fourteen months, seeds of the sample on which observations had been made when in fresh condition in 1908, when it was found that those seeds which had not undergone other changes now possessed resin cavities with dark-green contents. Hence it appears probable that Hanausek's observations were conducted on old seed.

Further, it was found that when seed of considerable age, of which the resin masses had become green, was crushed and mixed with water, the resulting mash was of a bright-green colour, exactly resembling the effect which originally called attention to the phenomenon in the case of the sample of crushed cotton seed first examined. (It is of interest in this connection to note that the resin waste from refining cotton seed oil is used for the production of a green dye.)

On cutting open and examining a number of fresh cotton seeds, it is generally found that a few of them are discoloured, being brown inside. This discolouration may vary considerably in extent, all stages being exhibited, from a slight to a complete change of colour. When thin sections of seeds affected in this way were examined under the microscope, it was found that the cell-walls were stained brown, and, in some instances, much disintegrated, and throughout the stained area numerous oil drops were distributed. It appeared that the brown staining was in all probability due to the bursting of the resin cavities already mentioned, whereby the contents became distributed throughout the body of the seed.

It was thought that possibly this might have been due to injury to the seed by the gins*, but the fact that the percentage of seed affected in this way tends to increase on keeping, would appear to negative this suggestion. Thus a sample of seed, which in February, 1908, showed a percentage affected in this manner of 34, presented, eight months later, 66 per cent. of seed similarly affected. It is interesting to record that this increase corresponds approximately with the coincident decrease in the percentage of germination.

It is not clear whether the death of the seed was connected with this appearance, though it seems likely to have been. If it was, it yet remains to be decided whether it was the cause or the result of the phenomenon.

(B.) *Effects of Storage on the Germinating Power of Cotton Seed.*

That cotton seed, on being kept, tends to lessen in its percentage of germination is a well-known fact. To investigate this, a quantity of fresh seed was taken in February, 1908, stored in the Government Laboratory for the Leeward Islands, and periodical germination tests were conducted on it.

The results are given below:—

Date.	Germination, per cent.
February 24, 1908	51
June 3, ,,	49
September 14, ,,	32
November 5, ,,	36
April 24, 1909	8

The seed was stored in a covered wooden box lined with brown paper. The germination tests were performed on 100 seeds; the germinator used was of the ordinary type, and was sterilized in every test by boiling before use. The seed used was from Centreville

* *Winton's Microscopy of Vegetable Foods*, p. 209.

* Injury by the gin may be sufficiently severe so that it is easily seen or that its effects are manifest in a short time. On the other hand, an injury from this cause, or from any other cause, such as the puncture produced by a cotton stainer or other insect, might be so slight that it could never be detected as an injury to the seed, and still be sufficient to liberate the enzymes which cause the changes in the substance of the seed. The action of enzymes being progressive and cumulative, the results in deterioration and in decreased geaminating power would be similar to those obtained by Mr. Tempany.—Ed. *W. I. B.*

cotton grown at Skerrett's Experiment Station. It will be seen that the percentage germination of the seed was low, and decreased fairly steadily on storage. It was found that the decrease in the germinative power was of the same order of magnitude as in the increase of the seeds which showed the internal brown discoloration mentioned above. This is illustrated by the fact that in February, 1908, the percentage of seeds thus affected was 34, while in November it was 66, as already stated.

To ascertain whether seed kept better if stored in an absolutely dry atmosphere, a portion of this same lot of seed was simultaneously preserved in a desiccator over strong sulphuric acid. In November, 1908, the seed was examined at the same time as that stored under ordinary laboratory conditions. The percentage of germination was found to be 26. On cutting open and examining these seeds, it was observed that a large proportion showed the brown discolouration seen in seeds stored under normal conditions, the percentage of internally-brown seeds being 69. As one would expect, all the seeds examined were very hard and dry, doubtless on account of the exceedingly dry atmosphere in which they had been kept.

It appears, therefore, that storage under conditions of extreme dryness does not favourably affect the rate of deterioration.

SUMMARY OF CONCLUSIONS.

a. Cotton seed undergoes certain changes on being stored.

b. The contents of the resin cavities undergo a change, the nature of which is not known, whereby the original brown colour is changed to green.

c. The resin masses tend to become ruptured, causing brown discolouration and disintegration of the internal tissues of the seed.

d. The germinating power tends to decrease on storage. This appears closely to follow the increase in the percentage of seeds showing brown discolouration, but whether this latter is a causative or consequent factor of the decrease of the percentage germination is not clear.

e. The storage of cotton seed under very dry atmospheric conditions does not appear to affect favourably the decrease in germinating power, as compared with storage under normally dry conditions.

THE EXTENSION OF CULTIVATION OF FIBRE PLANTS IN INDIA.

(From the *Agricultural Journal of India*, Vol. IV., Pt. IV., October, 1909.)

The following is a report drawn up by a Committee consisting of Messrs. Gammie, Burkill, Finlow, Clouston and Subba Rao, for the information of the Board of Agriculture. It was prepared in 1908, laid before the Board for criticism, and subsequently slightly amplified by the Committee, on information obtained by the Inspector-General of Agriculture from the Directors of Agriculture of the various provinces :—

The Committee limited consideration to particular crops :—

(1) Ryots' crops—Jute, *Hibiscus cannabinus*, *Crotalaria juncea* and Coconut.

(2) Capitalists' crops—Rhea, Agave, Pine-apple, Sansevieria and Flax.

(3) Fibres worth experimental attention, *e.g.*, Plantain, Malachra and Sida.

Jute.—At present the cultivation of jute is practically confined to Bengal and Eastern Bengal and Assam. In both of these Provinces, it is one of the most important crops, and its cultivation increased rapidly, owing to high prices until 1907. During the last two years, however, there has been a diminution of between 30 per cent. and 40 per cent. in the area under jute, caused, partly by low prices, due to bad trade and to over-production, and partly, by the great rise in the price of rice produced by famine conditions in Bengal and in other parts of India. While there is little doubt that, in some districts, jute has replaced rice to a certain extent, the ryots who grow jute now generally know that paddy or a rabi crop can usually be grown in the same field in the same year. This should be considered by those who think that the extension of cultivation of jute would seriously interfere with the food-supply of the country, for, on the other hand, the little diminution in outturn of rice caused by increase of jute is more than compensated by the enhanced buying capacity of the country on the return of the more profitable crop. The cultivation of jute is extending in Assam and is very profitable there, where large areas of virgin land are available for the crop. Its cultivation increased rapidly in Behar during the years 1904-1907 when prices were high; but latterly the area has decreased to about one-third. Its place in the crop rotations of this tract is still indefinite. During the last four years, trials with jute have been made in

other parts of India. The results of the experiments indicate that jute might be grown in—

(*a*) The Deltas of the Godavari and Kistna, Madras (with irrigation).

(*b*) The Malabar Coast, Madras.

(*c*) The Chhattisgarh and Nagpur Divisions of the Central Provinces (with irrigation).

In the Madras Presidency, a number of private landowners are trying jute in small areas on the Malabar Coast districts. Experiments in the Kavery delta have been abandoned, as want of skill on the part of the cultivators and the remunerativeness of paddy augured no success. The same causes will probably hinder progress in the Godavari and Kistna deltas. In the Central Provinces, the crop will continue to be grown on demonstration plots. Its cultivation will probably be limited to tank-irrigated areas where it may possibly alternate with wheat, the latter being a dry rabi season second crop. In Bombay, the experiments were not successful, and the crop is not likely to be introduced on a large scale anywhere in the Presidency. It is not likely that Jute can be profitably grown in the irrigated districts of the Punjab, unless practical arrangements can be made for retting the crop. Artificial tanks filled from the canals would as a rule be required. In the United Provinces of Agra and Oudh there does not seem to be, at average prices, much room for this crop in the districts served by the canals, and if the crop is grown to any extent, difficulties many arise, as in the Punjab, in making proper arrangements for retting. Jute has been successfully cultivated in the lands belonging to the Maubin Jail in the Irrawaddy Delta for a number of years; but although this success has been duly advertised and quantities of seed have, from time to time, been distributed to other parts of Burma, the experiments have failed to induce general cultivation. The crop has not become popular in Burma probably on account of the dearness of labour and the extra trouble involved in its cultivation as compared with paddy; but a number of private individuals have taken up jute cultivation in an experimental way. The suitability of the crop for Lower Burma will be particularly studied at the Hmawbi Agricultural Station, especially in regard to the right times of sowing, the varieties which can be most profitably grown and the possibility of growing rice and jute on the same land in the same year. It is believed that the development of jute cultivation, on any commercial scale, will depend on the erection of a Jute Mill in Rangoon or any other convenient centre, but the cost of labour in Burma, as compared with India, may form a serious commercial disadvantage.

Hibiscus cannabinus (Ambadi, Mestapat, Gogú, Sankukra).—This plant is cultivated in many parts of India as a mixed crop, but rarely as a pure crop excepting on the East Coast of Madras, and, to some extent, in the jute-growing districts of Bengal. It grows excellently on well-drained land in a wet climate, such as may be found in the jute districts; but it is capable also of thriving under conditions which would not suit jute without irrigation. In this last fact lies the importance of the plant. There is no advantage to be got by extending its cultivation where jute will easily thrive; but in regions of more moderate rainfall the cultivation of *Hibiscus cannabinus* might profitably be extended. In Madras, its cultivation is firmly established in Vizagapatam and Guntur, which include 6/7ths of the total acreage of the crop in the Presidency (68,000 acres in 1906-07). In 1907-08, when the total acreage was 71,476, it was, in these two districts 60,620 acres. It has been suggested that the quality of the fibre has deteriorated, but enquiries made on the spot in 1906 indicated that the alleged deterioration is due to fraudulent watering and to carelessness in preparation owing to high prices, rather than to any actual deterioration of the plant. Prices have recently been low. A mill for spinning this fibre and manufacturing it into gunnies has been worked for some years at Bimlipatam, which probably accounts for the considerable area under the crop in the Vizagapatam District. Another mill has recently been opened at Ellore in the Kistna District and may encourage extended cultivation. The total acreage under this crop in 1906-07 in the Bombay Presidency was said to be 145,623, but for 1907-08 only 97,821 acres are recorded. It is generally mixed with other *kharif* crops, and the fibre is used chiefly for well ropes and for other home purposes. In the Central Provinces, it is grown in mixed crops. Its fibre is considered inferior to that of *Sann* (*Crotalaria juncea*); the general opinion being that *Sann* gives a better outturn of fibre and a greater profit per acre when each crop is planted alone. The extent to which *Hibiscus cannabinus* is grown as a mixture with other crops in the United Provinces is not known. It is usually grown as a border crop, and calculations regarding

areas and outturn are very uncertain. The fibre obtained in the east of the United Provinces is perhaps of better quality than that grown in the west. It occupies in the Punjab an insignificant area. It is frequently grown as a border crop round sugarcane, cotton and maize, as a protection against straying cattle. It is never grown in separate plots. The produce is chiefly used locally. It is cultivated, to some extent, throughout Upper Burma; but it is not likely, in the near future, to have any particular commercial importance. The total area is at present about 10,000 acres.

Crotalaria juncea.—The fibre of this crop does not compete with jute as does that of *Hibiscus cannabinus;* but in market value it is superior to both. Sann-hemp can best be grown in districts of moderate rainfall, and, therefore, does not compete with rice. It is, in some parts of India, frequently grown as a green manure crop before rice, and in others as a second crop in the same year after early rice for fibre. This rotation is advantageous, because *Sann* is a leguminous crop. The total acreage under the crop in the Bombay Presidency in 1906-07 was 23,700 acres and in 1907-08, 25,470 acres. It is chiefly grown as a *kharif* crop for fibre, but also to a considerable extent as a green manure crop. In the Thana District it is grown as *rabi* crop, in succession to early rice, for fibre, which is used by fishermen in making twine for nets. The returns for Madras give a total of over 300,000 acres; but it is known that only a very small proportion of this—less than 20,000 acres—is grown for fibre. It is most extensively cultivated for fibre in the Northern Circars, chiefly in the Amalapuram and Narsapur Taluks of the Godavari and Kistna Districts. In the rest of the Presidency, with the exception of the Tinnevelly District, where some fibre is manufactured into extremely durable gunny bags, the cultivation of the crop is confined to the production of fodder. In Eastern Bengal and Assam this crop is largely grown in the Serajganj sub-division of the district of Pabna, where the estimated area is 33,900 acres, and where it is generally grown, in the cold weather, on land which bears a jute crop in the same year. The area in Chittagong, where it is also grown as a *rabi* crop decreased from 7,900 acres in 1906-07 to 1,600 acres in 1907-08. The total estimated area in Eastern Bengal and Assam is about 42,000 acres, and the estimated export of the fibre is 30,000 maunds. In Eastern Bengal jute is much more important, but it is possible that the cultivation of Sann-hemp can be somewhat extended with profit, though as the water-supply for retting is limited in February and March, the months of its cutting, this would only be along the banks of rivers. In the Serajganj sub-division it is only grown for fibre quite close to water.

A note by Mr. Clouston, the Deputy Director of Agriculture in the Central Provinces, on the cultivation of fibre plants in the Central Provinces, was published in the *Agricultural Journal of India* (April, 1908). The total area under *Sann* in the Central Provinces was 55,400 acres in 1907 which increased in 1908 to 85,044 acres. In Berar the acreage was 32,360 in 1907 and 35,484 in 1908. It is always grown as a pure crop and is cultivated for its fibre chiefly; but the seed is a valued cattle food. It is generally believed that only one variety of *Sann* is grown throughout the Central Provinces and Berar. Retting costs a good deal, and a suitable cheap machine to extract the fibre might be advantageous in extending the cultivation. The area in the Central Provinces has nearly doubled during the last ten years, where *Sann* cultivation is so profitable that the crop has been largely substituted for wheat. The cultivators understand that this crop is a hardy one and improves the condition of the land. It is grown to a small extent as a green manure crop, particularly for irrigated wheat and sugarcane. In the cotton tracts no extension of this crop can be expected, as cotton pays better. In the rice tracts, *Sann* could probably be profitably grown on much of the land which is planted with other second crops. The total quantity of Sann-hemp exported from the Province and the value of the same from 1904 to 1906 are shown below:—

Year.		Maunds.	Value.
1904-05	...	226,751	12,18,783
1905-06	...	201,402	10,82,534
1906-07	...	168,096	9,03,513
1907-08	...	271,727	14,60,532

In the Punjab there were 57,000 acres under Sann-hemp in 1906 and 52,400 acres in 1908. The sub-montane tracts showed the greatest area, very little being grown in the south-west of the Province. Throughout the Punjab, the crop is usually sown in very small plots, and very little is marketed. The crop is sown almost solely for fibre, but in the Hoshiarpur District, it is estimated that 1-10th of the crop was grown for green manuring. The practice of green manuring with *Sann* is rare at present. The retting and cleaning of the fibre are regarded as being tedious and expensive,

and Sann is consequently considered to be less remunerative than some other crops. The imports of Sann-hemp fibre into the Punjab in 1906-07 were 15,382 maunds and in 1907-08 20,984 maunds, almost entirely from the United Provinces. The exports amounted to only 4,078 maunds in 1906-07 and 2,584 maunds in 1907-08.

The returns of the United Provinces show an area in 1906-07 of 133,000 acres of hemp, which include both *Hibiscus cannabinus* and Sann-hemp: and in 1907-08 of 158,000 acres. Practically the whole of this area is devoted to Sann-hemp, which is grown for fibre and almost universally also as a border crop with *kharif* crops. Part of the produce is worked up by cultivators into ropes for home use; but the export is considerable. The trade returns of the United Provinces for 1906-07 show practically no imports of hemp, but exports aggregating 400,000 maunds valued at 22 lakhs of rupees and in 1907-08 of 409,800 maunds, valued at Rs. 26,15,000; most of this is Sann-hemp. There is a steady trade with Calcutta and a very fluctuating trade with Bombay. The crop is a well recognized feature of the local agriculture, and the trade in fibre is an organized one. The area generally responds to the prices offered.

The crop does well in the Tavoy District of Tenasserim, where it is grown there after paddy. The estimated area is about 400 acres in Lower Burma, when the fibre is used for fishing nets. It is very doubtful whether there will be any great development of Sann in Burma unless the Department of Agriculture succeeds in introducing it for green manuring.

Coconut Fibre.—The coconut palm is grown in all the Coast districts of India, but to the largest extent, in the southern portion of the Bombay Presidency and in Madras. In the Malabar Coast districts, the coir industry is a very large one, amounting to many lakhs of rupees per annum. Although this palm takes time to mature, its cultivation is popular, because it supplies food as well as fibre for many years after it has reached the fruiting stage. In Bengal it is plentiful in the lower Gangetic basin; but it exists practically only in garden cultivation; there are no large plantations. The coconut palm is grown on a large scale in Bakarganj and Noakhali in Eastern Bengal and Assam, but the fibre is never extracted. There seems no reason why this industry might not be introduced with profit into the Province.

Little, if any, attention has in the past been devoted to the fibre of the coconut in Burma, except in the jails. Even for food purposes coconuts have to be imported largely. The cultivation of the palm for fruit and fibre has been taken up in Akyab by one European. If he succeeds, his experience may attract attention to this crop. There is a coir factory in Rangoon, and the collecting of coir for it would seem deserving of encouragement. The want of sufficient cooly labour in Moulmein and other centres makes it impossible to start coir factories in them. The total area under this crop was returned as 13,590 acres in 1906-07, and 13,070 acres in 1907-08.

Plantain Fibre.—There are possibilities of a useful industry in plantain fibre. In many parts of India the plantain is common in every garden; and in Bengal, Assam, the Bombay and Malabar Coasts, the Delta tracts of Madras and in parts of Burma, whole groves of plantains are quite common. The fibre of the plant which produces good fruit in India is usually, however, far inferior to that of *Musa textilis*—also a plantain—which is the source of Manilla Hemp. Moreover, the amount of fibre obtainable from a plantain in India is very small. Experiments have shown that the fibre can be extracted by a simple hand machine; but in view of the low market price obtainable—as a rule, not much more than half that of Manilla Hemp—it remains to be proved that a plantain fibre industry in India is a commercial possibility. The fibre is of little use for the manufacture of cordage as its strength is below the standard usually demanded for rope-making. There are about 124,000 acres under plantains in Burma, but nothing is done with the fibre. The crop might give paying results for fibre after producing fruit.

Sida.—Species of Sida are quite common jungle plants in most parts of India; but in order to attain the length necessary for a fibre plant the crop must be grown on well-drained land, either in a moist climate or under irrigation. Experiments under these conditions have given promising results. It is, however, necessary to overcome certain difficulties before recommending the crop for general cultivation.

Agave and Rhea.—For the purpose of this note, Agave and Rhea may be taken together. The conditions of soil and climate suitable for these crops are now fairly definitely known. It used to be thought that Agave would grow and thrive on any soil and under any conditions of climate. It has, indeed, been stated that the poorer the land, the better Agave will thrive; but experience indi-

cates that both Agave and Rhea require good land for rapid growth. For the latter also fairly heavy rainfall is required. Although it is possible to extract both Agave and Rhea fibre by hand, the products obtained are usually inferior to those obtained by machinery. Therefore possibly the cultivation of these plants should, for some time, be continued by capitalists who can afford to pay for expensive fibre extractors. Rhea has been extensively cultivated on the estates of Indigo Planters in Behar, but has not proved a profitable crop. Both Agave and Rhea require some years' growth before they give any considerable yield of fibre, a fact which discourages the ordinary ryot from attempting their cultivation.

The results of the recent experiments at Dalsing Sarai and elsewhere have been set forth excellently by Mr. B. Coventry in the *Agricultural Journal of India*, 1907, pages 1-14; they practically proved that the climate of Behar, with a rainfall of 45 inches, is too dry to admit of a sufficient number of cuttings being made per annum to make rhea pay. This crop thrives in the moist climate of Assam, where it is possible to obtain five cuttings per annum, and where, to a small extent, it is a ryots' crop. In Madras, rhea is grown on a small scale in the Shevaroys. The Glenrock Company opened a rhea plantation near Metupalayam in the Coimbatore District 25 years ago, but did not make a profit out of the cultivation.

In Bombay, where rhea has been under experimental trials for many years, further recent experiments with it at the Ganeshkhind Gardens, Kirkee, have confirmed the conclusion that the soil and climate of the Deccan are unsuitable for the plant, It is said that in Lower Burma, a variety of rhea grows wild on the banks of streams in the Tharrawady District, along the foot of the Pegu Yoma range, and that the fibre is used to make twine for fishing lines. Experimental plantations of *B. nivea* and *B. tenacissima* have been started by the Forest Officer in Tharrawady, who reports that the latter species is growing with success. Rhea grows wild both in the Northern and Southern Shan States. The fibre is chiefly used for making paper, but is also made into cloth and strong twine for fishing lines, etc. Two varieties of the plant are known, one being considered better than the other for the above purposes.

Varieties of Agave are to be found in most parts of India under widely different conditions of climate and soil; but Sisal Hemp (*Agave sisalana*) is the only variety with which systematic attempts at cultivation have been made excepting by the prison authorities. Sisal Hemp yields the largest and quickest returns under careful cultivation on good land in a moist climate; but only one plantation (Dauracherra Fibre Company, Sylhet, Assam) has existed long enough to yield definite results, and these do not prove that Agave cultivation in Assam is certain to be a profitable industry. A few plantations of Agave exist in the United Provinces, but have hardly reached the cutting stage. The raw material which is at present dealt with is chiefly obtained from railway fences taken on lease. The only place in the Madras Presidency where Agave fibre has been extracted on a commercial scale is in the Coimbatore District from the plants growing along the railway lines. This species proves to be *Agave vera-cruz*. Several European planters are trying Sisal in the planting districts, and the Madras Fibre Company has some plantations in the Anantpur and Chingleput Districts. The cultivation of Agave is not likely to be taken up in the near future by ordinary ryots. The extraction of the fibre by hand is unpleasant on account of skin irritation caused by the sap. The chief purpose of the Hindupur Government plantation is to grow Agave experimentally on land where the rainfall is too precarious for other crops. It is also intended to supply Sisal plants to those who are interested in the cultivation of this plant. Agave has been but little exploited in the Central Provinces, and the cultivation is not likely to become popular. The common species there is *Agave cantala*. It is usually grown in hedges, around groves and gardens, but nowhere in abundance. Fibre is not extracted from it extensively. In the Kawardha Feudatory State adjoining Bilaspur, its cultivation is fairly large and the fibre is used in making ropes and cloth. The labour involved in extracting the fibre is considered both hard and degrading, while the juice of leaves produces eczema on the legs and arms of the labourers. Agave cultivation has been extended of late at the jails in the Central provinces, and the Inspector-General of Prisons had 87,459 aloes planted out last year in his various gardens. At these jails, all the work of cultivation, of extracting the fibre and of making it into ropes, rugs, etc., is done by the prisoners. This industry engages labour at all times of the year. On the *bhata* plains of Chhattisgarh where there are very large areas of waste land, it may

be possible to start aloe plantations; but if this is to be done successfully, the work will have to be undertaken by an enterprising firm with sufficient capital and practical knowledge. It has yet to be proved that the aloe can be profitably grown for commercial purposes on such soils without irrigation. Experimental trials are being made. So far as is known, the *Agave vera-cruz* is the only Agave found in Burma. It is not systematically cultivated for its fibre, though it is used in some prisons for rope-making. It is not yet certain whether Agave would repay cultivation, and in any case a better species than *A. vera-cruz* should be grown.

Fibre from Pine-apple and Sansevieria.—The extraction of fibre from pine-apple is not likely to become an extensive enterprise in any part of India. Sansevieria has been repeatedly tried by planters in Assam, but without paying results. It is possible that fibre can be profitably obtained from the pine-apple in Southern India.

Flax.—Flax as a fibre crop is not yet produced on a commercial scale in India; but extensive experiments were begun in Bengal about four years ago and are still in progress. They will, when complete, probably indicate that fibre of good quality can be profitably produced from this crop in several parts of India. There are large areas under linseed in the different Provinces, and in some places where the conditions are specially favourable, it may be possible to produce good fibre as well as seed. In other tracts the coarse stem of the country linseed may yield fibre which is inferior but still worth extracting. Experiments are, however, required to determine this, and also to show how such fibre can best be utilised. Flax cultivation has no particular prospect of success in the United Provinces, except perhaps in a few favoured localities; unless the growers can afford to stack their straw until clean water is available. Except on the Dharwar Farm, the different varieties of imported flax have not yet been found suitable for cultivation in the Bombay Presidency. It has, so far, not succeeded in Burma, but no very systematic experiments have yet been made. In the Punjab, 39,874 acres of linseed were sown in 1906-07, 14,669 acres being in the Kangra District and most of the balance in the sub-montane districts; but in 1907-08 only 29,348 acres were sown. The crop is grown for seed. It is thought that good material for fibre has been obtained from trials made with Russian linseed; but the difficulty lies in the retting, which is being studied at Lyallpur as well as at Pusa and at Dooriah in Behar. Experiments in the Punjab which were conducted many years ago were well reported on as regards the growth of the plant; but the retting question was not then fully examined. The local variety of the Punjab is not suitable for fibre purposes, owing to its established habit of short and bushy growth.

Malachra Capitata.—The Bengal Agricultural Department tried *Malachra capitata* at Cuttack, but gave it up as hopeless after two years' trial. Similarly, experiments conducted at the Rajshahi Experiment Station in Eastern Bengal and Assam, indicated that its cultivation is not likely to be profitable. Experiments have not yet been made in other provinces.

General Conclusion.—The Committee believes that it is possible to extend largely and profitably in the immediate future, the cultivation of Jute, Sann-hemp and *Hibiscus cannabinus*, and that, later on, it is possible that a portion of the linseed grown over large areas in various parts of India may be utilized for the production of fibre as well as seed. A considerable increase of Agave cultivation is possible in Assam and in tracts which have similar physical and climatic conditions. Successful rhea cultivation must apparently be limited to a comparatively narrow zone where both climate and soil are particularly suitable. The Committee affirms that jute is a very paying crop and believes that it can usually be followed by a food crop in the same year.

The Committee lays great stress on so arranging the rotation of food and fibre crops, that the encouragement of the latter shall not be at the expense of the former. From this point of view, those fibre crops, which occupy the ground for one season only, are preferable to those of a perennial nature.

The Committee believes that the demand for fibres is bound to increase, as they are essential for nearly all branches of trade; also that it is not likely that prices will fall so low as to render fibre cultivation in India unremunerative.

DRUGS AND MEDICINAL PLANTS.

THE TOBACCO INDUSTRY.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 11, November 1, 1909.)

The tobacco industry is somewhat seriously handicapped in many parts of India by the heat and dryness of the climate, but those who had studied the matter are well aware that excellent tobacco can be grown in this country, though the climatic conditions are hostile to the curing of the weed. Good curing, it is needless to say, is absolutely necessary if a high class product is to be obtained Another thing which militates against the production of really good tobacco is that this crop, perhaps more than any other, demands care, skill and sound judgment on the part of the producer to secure a marketable leaf of good quality. Tobacco is not only a difficult crop to grow; it is also a risky one unless all possible precautions are taken. The plant is very sensitive to the surroundings in which it is grown, and its physical character is greatly influenced by soil, climate, manures, and the care or neglect which it receives at the hands of the grower. Moreover, the plant is very liable to the attacks of certain insect pests and to fungus disease. These considerations are brought out prominently in an article on the Indian tobacco trade which appears in the latest issue of the *Indian Trade Journal*. It is pointed out that Indian tobacco is not only grown from inferior plants but is cured in a very primitive style. This crude stuff, however, seems to be considered good enough for the manufacture of the native cigarette or *biri* (sold at ten annas or less a thousand) and for export to Burma to be mixed with other tobacco and made into what is known as the Burma cheroot. This, we are informed, is at best a very rank sort of cigar—an assertion that will very possibly be disputed by those who have acquired the taste for it. Indian tobacco, on the whole, is not nearly up to the standard required for export to European countries, where there is a keen demand for first-class leaf. The *Indian Trade Journal* goes on to say that experiments are now being carried out at Pusa with various kinds of tobacco to discover the best variety for exploitation in this country, and it is suggested that central curing factories should be established in certain tobacco tracts and controlled by experts who have had long experience in America. An undoubted demand exists for properly cured Indian tobacco, and since the climate is hostile to good curing, the best chance of securing a good quality of leaf is to establish properly equipped factories where the conditions of heat and moisture necessary for the curing process may be artificially produced,

QUININE IN INDIA.

(From the *Chemist & Druggist*, No. 1, 552, Vol. LXXV., October 23, 1909.)

The fact that a Malaria Conference is now being held at Simla has excited some interest on this side, and a report has been current on the markets that the Indian Government may possibly sanction a general and free distribution of quinine in the malarial districts; but we are afraid the report has been circulated more as a "bull point" for quinine than anything else, and that the wish is father to the thought. As throwing some light on the distribution of quinine in India, we notice that a recent number of the *United Province Gazette* contains a resolution signed by the Lieutenant-Governor of the Punjab, which accepts the principle that quinine should not be distributed at the public expense, unless it is absolutely necessary to combat a severe epidemic of malaria. From past experience it is calculated that the amount which could be distributed among a million people would be from 25,000 oz. to 30,000 oz., not a very large amount. This, it is presumed, is quinine manufactured by the Indian Government. The above resolution also states that "the Lieutenant-Governor approves the Committee's proposals to increase the amount of quinine sold for a pice (¼d.) from 7 gr. to 9 gr." Additions to agencies for the sale of these packets are under consideration, and arrangements have been made for the experimental issue of the drug in the tablet form, three tablets of three grains each being contained in a packet. It is quite possible that the larger the sales the greater will be the loss to the Government, considering that 9 grains is sold for a farthing, but the inference seems to be that, whatever the loss, the Government is anxious to incur it in its efforts to encourage the use of the drug as a prophylactic. Recently several important changes have been made by the Government in order to effect economic distribution of quinine, the chief being the concentration of the "putting-up" of packets

at the juvenile gaol at Alipore, where thirty boys are engaged in the work. Special arrangements have been made to stock the tablets in large quantities, and the Inspector-General of Prisons is confident of being able to meet any sudden demand when malaria appears in epidemic form. He reports that over four millions of pice packets were made and despatched to various post-offices during last year, and operations henceforward are to be on a much larger scale, which probably accounts for the fact of the recent purchases in London, but those, it need hardly be said, did not awaken any responsive chords in the quinine-market here, speculation being to all intents and purposes dead. In view of this increased consumption of quinine, the annual reports of the two Government cinchona-factories in India for the year 1908-9 are more interesting than usual. Last autumn, it appears, there was a considerable demand for quinine when a widespread epidemic of malaria occurred, and both the Madras and Bengal factories readily disposed of their stocks. The former produced about 420,000 oz. of quinine, or 128,000 oz. more than the annual average, but it must not be supposed that this was all indigenous bark. On the contrary, the output was the result of working up Java bark imported into India from Amsterdam, the yield being 5·5 per cent. of quinine sulphate, against 3·1 per cent. from Indian bark. In the Bengal factory, where the output of quinine was about 586,000 oz., Java bark was also used, the percentage of quinine being 6·71 per cent., as compared with 3·59 per cent. from local bark. The question arises: Why should not the Indian Government be in a position to import bark direct from Java? Valuable analytical work has been accomplished at the Bengal factory during the year, and some time has been devoted by the quinologist and his assistant to the production of quinine tablets. The results were very satisfactory, and it is now stated that the factory, if required to do so, could turn out tablets in any desired quantity, with the necessary additional machinery. Entirely new arrangements have been made for the re-crystallisation of quinine sulphate, and a quinine-drying room has been built with the machinery essential for maintaining a constant supply of fresh air. The profit of the Bengal factory was Rs. 1,29,805, but as the price of the quinine was estimated on the highest market rate rather than the average, it is doubtful if such a profit would be realised if the quinine was suddenly thrown on the market.

EDIBLE PRODUCTS.

RICE-CROP PROSPECTS, 1909-10.

LAND RECORDS DEPARTMENT, BURMA.

BY H. M. S. MATHEWS,

Commissioner of Settlements and Land Records, Burma.

(*Summary of Rice-crop Forecast for the month of October, 1909.*)

(On an average of the five years ending 1907-08, the area under rice in the territory to which this forecast relates has represented some 10·02 per cent, of the total area under rice in British India.)

The area under rice cultivation in the fifteen chief rice-producing districts is now reported to be 7,571,559 acres. Corrections of local estimates of planted areas are the cause of the reduction of 20,733 acres from the estimates of October. Notwithstanding favourable early rains, comparison of the area planted this year as estimated by District Officers with last year's actual area shows less than the ordinary rate of annual increase; and owing to the extensive destruction by floods (now reported as 232,499 acres), the nett increase is further reduced to 5,480 acres. In localities immune from floods, however, the rains have continued favourable with late showers in November, and the crop is reported almost everywhere to promise an excellent harvest.

Rangoon, 12th Nov., 1909.

ADDITIONAL NOTES ON RICE CULTURE.

(From the *Philippine Agricultural Review*, Vol. II., No. 7, July, 1909.)

METHODS OF SEEDING.

In addition to the report on rice cultivation in Zambales and Pangasinan published in the May number of the Review, the writer desires to mention a third method of seeding, or preparing the "semillero" practised by the rice growers

of a great portion of the Province of Nueva Ecija. This is done where the water supply is under control. The ground, as usual, is ploughed and harrowed three or four times, or until it is well pulverised for good germination. The seed is put in a rice sack and then placed in water and left there to soak. After three or four hours the seed is removed from the water and hung up wet for about twenty-four hours, or until at least about 50 per cent. of the grains have sprouted, when it is sown broadcast on strips or lots about 8 or 9 feet in width. The soil at the time of sowing must be well saturated and kept in that state until the young plants have acquired sufficient height and vigour to stand more water. Some farmers keep their seed beds under water all the time, while others cut off the water supply for a day or so every once in a while and thus expose the growing plants and the soil to the free action of the sunshine and air.

Of the three methods of seeding—namely, (1) the one described in the foregoing, (2) that by drilling the seed, or the Ilocano method, and (3) that by sowing it without sprouting on a drier bed than that used for sprouted seed—I have been informed by almost every one who is familiar with them that the Ilocano method of drilling is the surest, especially where there is any danger from lack of rain or the water supply is not under control. The seed being equal, the Ilocano method generally gives a germination of not less than 90 per cent., while either of the other two methods gives only 75 or 80 per cent. or less. On the other hand, the seed stools less with the Ilocano method of seeding. There is no noticeable difference, however, in the behaviour of the plants transplanted from seedlings produced by these three different methods of seeding.

In Tarlac Province, especially in the municipalities of Capas, Tarlac, and Concepcion, dry-season rice growing is more or less practised. Of course only those lands with artificial irrigation can be utilised for this purpose, and there is only a small area in each town that has such requirements. There are a number of varieties adapted to the dry season. They are collectively called "palakaya" or "tag-araw" rice; "inita," an awnless variety, is the one mostly grown. The planting is done during the early part of February and the crop is harvested in May. The process of growing or cultivation is very simple: After the land is cleared of the regular crop—about the middle of January the field is flooded, drained, and then the rice stubble is ploughed under. Some plough the ground a second time, then it is harrowed and the seed is sown broadcast while the soil is still saturated. I cannot give the exact rate of sowing because I could find no one who was able to furnish such data. From what I have seen, however, I reckon it to be about 1½ *cavanes* of seed to a *balita* of land, or about 375 liters (10 bushels) per hectare. After the seed has germinated and rooted, and is therefore free from the danger of floating or being washed away, should there be any danger of the young plants suffering from drought, it may be watered again and drained. The water has to be kept on after the plants have produced three or four leaves and cut off again after they have fully headed. It is said that only from 6 to 10 "cavanes" (450 to 750 liters), generally about 7, of crop are obtained from dry-season rice.

In Zambales Province the highland rice growers, like the American Indians, I am told, practise boiling the rice before hulling it, after which it is cooked and used for food. This is done when the rice has been freshly cut and thrashed and sometimes is still green, or when there is not enough sunshine to properly dry the paddy. The process of boiling is rather one of steaming than actually boiling. It is believed, and I know it is a fact, that by so doing the rice kernel is made tougher and thus is better able to stand the pressure of hulling.

IMPROVEMENTS IN PADDY CULTIVATION.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 7, July 1, 1909.)

Ryots in our Presidency can learn a good deal from the improved methods adopted in cultivating paddy at the Court of Wards' Home Farm in Sivagiri in the Tinnevelly district. Sivagiri lies about six miles from the foot of the Ghauts. The average rainfall is about 25 inches per annum. The Home Farm consists of 252 acres of wet land under four tanks, besides dry and "poramboke." The soil under tank irrigation varies in texture from sandy to clayey loam, the sub-soil is clayey and overlies a bed of nodular limestone. Some of the land is very much subject to drought, whilst other portions were originally saline, but have now been much improved. The farm has been under the management of the Court of Wards for a considerable number of years, but it

was only about eight years ago that the operations were begun for introducing improvements in the cultivation of paddy for which this farm has become famous by reason of the success attained. The lines upon which improvements have been introduced may be briefly reviewed here. First as to ploughing, the ordinary wooden plough has been almost superseded by an iron plough made on the same principle as the local wooden plough. These iron ploughs are used both for ploughing dry, and in puddle, and it is surprising with what ease the small farm cattle seem to pull them and the ploughmen (when at least they have become accustomed to them) prefer them to the old wooden plough, because three ploughings with this iron plough produce quite as good a tilth as five with the wooden one. The action of this improved plough is to cut the soil into slices or furrows and turn the furrows over face downwards, thus burying the weeds for the sake of which it is necessary to plough so often with the wooden plough. These iron ploughs are made by the village blacksmith from old shipsplates bought from Rajapalayam in the Srivillputtur Taluk. The total cost, without draught and yoke poles, is about Rs. 6, and anyone who wishes to purchase one may order the same from the Farm Superintendent. As regards manuring it is well known that paddy is a crop which exhausts the soil, and (if the irrigation water is not heavily laden with silt) manure of some kind must be put on every year if good crops are to be obtained. Experiments carried out from year to year at Sivagiri show that the best and cheapest manure for paddy is that obtained from the dung, urine, and litter of animals which has been properly, whilst rotting, commonly known as farmyard manure. On this Home Farm all the manure which can be conveniently collected both on the Farm and in the village is gathered up every day and put into pits and well mixed up with litter and refuse and left until it is sufficiently rotten. Whilst rotting, it is occasionally moistened with water or urine to make it rot more quickly and in order to prevent its becoming too heated. To protect it from the scorching sun, it is kept covered with a layer of tank silt or soil. Because of the immense quantities of cowdung used for fuel and also because the farm livestock of this country are so poorly fed, the amount of farmyard manure available is by no means sufficient to maintain the fertility of the paddy lands up to an average standard. It is, therefore, absolutely necessary to devise cheap and convenient methods of obtaining other kinds of manures besides farmyard manure, and this branch of investigation has received a great deal of attention at Sivagiri and with great success. Of all the supplementary manures used, the most successful in producing results have been leguminous plants. Kolingi and sann-hemp have been used for green manuring in the Home Farm. Another excellent manure available in large quantities at Sivagiri is "tank silt." It is applied alone to saline lands on the Home Farm which have been greatly improved thereby. It is also mixed with the farmyard manure. This silt is dug up from the tank bed and thrown down the outer side of the tank bund at a cost of one anna per cubic yard. The most important factor in the successful cultivation of wet paddy is the possession of a sufficient supply of irrigation water from the time of transplanting up to the time when ripening is well advanced. It has long been considered by some, however, that the quantity of water said to be necessary to grow a crop of paddy, according to the variety of the paddy and its environment, is far too large. It was with the object of trying to prove the truth of this that experiments have been carried out for the last 3 or 4 years at Sivagiri. The results of the experiments go to show that a grievous waste of water does occur when paddy is irrigated according to the customary method at Sivagiri. Quite as good crops have been obtained in many cases with 30 inches of irrigation water as with 60 inches, provided the former amount is used judiciously. In the case of a five-months crop of paddy transplanted one month after sowing in nursery, it is customary to keep the plots deep in water after the transplanted plants have picked themselves up, in order that weeds may be smothered. It is well known that paddy can have too much water known as "neer-shavi" (waterchoked crop). If the wet land was ploughed in the dry season or even a month or so before the time for puddling, as nursery beds are, the weeds would already be killed and would not require drowning with water, and much of the water which runs to waste at this time would be saved up in the tank or canal. Even when the weeds are killed, it is customary to still keep the plots deep in water, and it is only a short supply running from the sluice gates which forces a reduced level in the plots; the result is that, if the supply of water fails, paddy grown under these conditions almost immediately succumbs to drought, but it is found that paddy irrigated and then

allowed to become almost dry between each application of water can withstand drought for a longer time. Large areas of paddy have been grown in seasons of scarcity on the Home Farm by not letting irrigation water into the plots until the surface of the soil had just begun to crack. Seed is specially selected every year from the local varieties of paddy which prove most profitable and also from the introduced varieties. This is used as Home Farm seed the following year. Some selected seed is also available for sale to ryots. The selection is done by picking out the best ears immediately before or after the crop is cut. These are bundled and thrashed separately, and the seed is carefully dried in the sun and stored in large earthenware pots. Special attention is paid to picking out ears which are quite true to the variety and quite free from disease. Care is also taken that all the grains in the ear are fully ripe and close-set. An ear is rejected if many of the grains have already been shed from it, and also if the glume or outer skin of the grain is empty. Seed is not usually selected from crops growing on patches of ground which are badly drained, even though the ears thereon are good specimens of their kind, unless it is a variety of paddy which is specially suited for water-logged soils like "Kulavalai" paddy. On the other hand, ears are picked from a crop growing on a plot which has been subjected to drought, even though the ears are not quite so large and good as ears of the same variety growing on a plot which has not been subjected to drought. One of the chief points to be considered in the selection of most varieties of paddy seed is to try and increase the "drought-resisting" power of the variety, even though the yielding power is slightly decreased.

CULTIVATION OF TEA IN THE KACHIN HILL TRACTS OF KATHA, BURMA.

BY C. K. DAVIS,

Civil Officer, Kachin Hill Tracts, Burma.

(From the *Agricultural Journal of India*, Vol. IV.. Pt. IV., October. 1909.)

Civil Officer, Kachin Hill Tracts, Burma.

Kachins are great tea imbibers, and it was not surprising to find in the course of my recent tour in the Kachin Hills of the Katha District that almost every village tract boasted of a number of trees varying from 60 to 6,000. The plant is probably the same variety which occurs wild in some parts of Burma.

The gardens which exist have not been laid out on any system and small patches of from 20 to 60 trees may be encountered in the thick of the jungle, each with its owner. The gardens or claims are not fenced. Each man knows the number of trees he owns. All the care the owner bestows on his claim is to clean the undergrowth, leaving only the young tea plants that have grown of themselves from seeds shed. Too great care, it is said, will kill the trees. No kind of manure is ever used. Efforts to sow seeds are only successful in a measure and things are left very much to Nature. An enterprising Shan of Thayagon, a village at the foot of the hills in the Mawlu Township, has year in year out, failed to grow from seed or transplant young trees to his village. He has now discovered that tenderness and care are wasted on the seed, a handful of which, if thrown into a clump of plantain, gives excellent results. The seeds germinate readily and displace the plantain which is cut away. It is noticeable, however, that the tea gardens are only found where the water easily drains away and there is much shade.

The following method is adopted by the Kachins in raising plants from seed. Seed collected is sown just before the rains commence in circular beds of two feet diameter. The earth is dug up a span or two and in the deeper holes stones are placed at the bottom. The seeds are then thrown in and covered over with the earth which has been excavated. Dried leaves are sometimes thrown in. No further attention is paid. At the beginning of the following rains the seedlings have attained a height of from 6 to 10 inches. They are then transplanted. Fair-sized stakes are fixed to the earth to mark the locality of the little plant and to protect them from being trampled on by cattle. In some cases the seedlings are not transplanted till they are two years old.

Like teak seeds, tea seeds are said to come up spontaneously after a clearing has been fired. Seeds that have been scattered by Nature and buried under dried leaves and twigs have then a chance of springing up. In many places lands devoted to taungya or shifting cultivation have developed into tea plantations.

Three years after transplanting, the Kachin nips off the tops of the young

plants by way of pruning them. The following year they are ready to be picked. Frequent picking without pruning gives a fair yield and the Kachin is satisfied.

The tender leaves are first picked in the month of April and they are ready to be picked again every alternate month up to August. The April pickings are the best and later pickings have not the same market value and fall as much as one-half in price. What is picked is either boiled or broiled according as wet or dry tea is required. What is boiled is squeezed with the hand on cooling to release the water and is packed in leaves in convenient packets for sale. It is sometimes put into big bamboos of one viss capacity which are plugged at the open end with bamboo leaves and buried two feet under ground. This keeps as long as two years. Wet tea sells at four annas a viss (3·60 lbs.) at Mohnyin on the line of railway.

The leaves that have been broiled are kept over the fireplace in the house, and when enough has been collected, they are smashed with the hands and rammed into green bamboo tubes about 18 inches long and 1½ inches in diameter. The green bamboo, in the operation of filling, is placed over the fire or in hot ash and what moisture is contained is absorbed by the dried leaves which in time form a hard cake in the bamboo. Such tubes contain from 25 to 40 ticals and sell at two annas and eight annas each. Dry tea is also sold loose at Rs. 4 a basket of four viss.

A plant is said to attain a girth of ten inches in ten years. There are trees with two feet girth, said to be 25 and 30 years old. The average yield of a plant is one viss of dry tea a year. The big trees yield according to Kachin methods as much as two viss.

Insect pests are not unknown on the Kachin Hills and their inability to guard against them is a source of great anxiety to the Kachins.

The Kachins do not pluck tea systematically or with a view to trade. During such time as the women can spare from taungya work and household duties, they pick enough for home consumption and perhaps a little extra to buy salt and cotton yarn with. The tender leaves only shoot forth in taungya cutting time and the industry cannot receive attention even as a secondary occupation. The men find more profitable employment with the timber firms which pay them handsomely.

Tea is brewed by Kachins in a small bamboo which serves as kettle, tea-pot and tea cup. Water is boiled in the bamboo, caked tea is scraped into it, and when the concoction has cooled a little, it is sipped and passed round.

Shans and Burmese who have acquired a taste for Kachin tea prefer it to imported brands. If taken up on a commercial basis. the cultivation of tea on the Kachin Hills would be profitable. At present the markets of Myitkyina and Katha districts could be confidently counted on. At Kongra (square No. 33 K) a man came to purchase bamboos of dried tea which he took away to sell at the Jade Mines in the Myitkyina District. He brought at three bamboos a rupee and expected to sell each at eight annas to a rupee.

There is some hope that the tea industry will be taken up in earnest by the hillmen. It is asserted that before the Kachins took to working for a monthly wage much tea was exported from the Kongra and Lamai tracts on the Western Range, and that to this day Kongra-Lamai tea is well known in the plains.

A MECHANICAL POLISHER FOR CACAO.

(From the *Agricultural News*, Vol. VIII., No. 190, August, 1909.)

The following information respecting a mechanical polisher for cacao, invented by Mr. George Barnard of St. Lucia, and known as 'Barnard's Patent Cacao Polisher,' has been received through the Acting Agricultural Superintendent in that island :—

This cacao polisher consists of a hollow cylinder, made of wood or iron, through which runs a shaft on to which are keyed a number of 'eccentrics.' Attached to the lower or under side of these eccentrics are feet or 'pedals' which are jointed, like the human ankle, in order to give a rocking motion as the eccentrics rise and fall. Hard rubber pads are attached to the bottom of these pedals which give under pressure to prevent the beans from being crushed ; an additional safeguard against crushing is that the pedals do not come within 2 inches of the cylinder, and are spaced sufficiently far apart on the shaft to allow the cacao to stir about freely and become thoroughly mixed as the pedals rise and fall alternately.

The cylinder and shaft are run in opposite directions, so as to complete the stirring of the beans, in order that each bean shall get an equal amount of polish. The cylinder is driven at the rate of ten revolutions per minute, and the shaft at sixty to eighty. At this rate of work, the machine in operation at Park estate, which is a four-pedal machine, polishes one bag of cacao of 200 lb. in ten to twelve minutes. This is a record unattainable by the present method, in which the polishing is done by means of the human foot. The machine may be had in various sizes, from those which may be worked by hand to those which are engine-driven. The beans are fed into the polisher and damped (just as at present) before starting and, on removal, are placed either in the sun on trays or direct into the drier. Thus it will be seen that with a polisher and a drier the cacao planter is now enabled to hold his own against the uncertainty of the weather, the excessive rainfall in some districts at the reaping season, or the indolence of the labourer.

INDAIN SOY BEAN

(From the *Indian Trade Journal*, Vol. XV., No. 189, November 11th, 1909.)

The Indian press in echoing the repeated allusions made by this Department to the importance of the trade in the Manchurian soy bean, and to the menace offered by it to India's business in other oilseeds, is in some danger of doing injustice to the Agricultural Department which is working in the background. The Commerical Intelligence Department has done no more than to draw the attention of the public and of other Departments of Government to those trade developments which is its function to mark, and to bring together such relevant data as were on record. As soon as this was done it was found that India's knowledge of the soy bean was not limited to the indigenous variety known as *Glycine Soja* (or *G. ussuriensis*), but that the Agricultural Departments in several provinces had practical experience of the cultivated plant. As long ago as 1885 the seed was tentatively grown as a possible food crop by the Agricultural Department at Nagpore; and the Annual Report of the agricultural stations in the Central Provinces, which has just issued, contains a reference to the cultivation of a small plot and to the absence of a local demand. Other provinces also made some experiments. In those days the merits of the soy bean as a source of oil were scarcely recognised, and no demand for it on this account existed in western countries. Consequently the cultivator found small profit and the agricultural authorities as little encouragement in their attempts. But the crop was never quite lost sight of; and, so soon as a foreign demand for the seed appeared and was brought to the notice of the Agricultural Department, it was able to supply small samples of the produce grown in India. These were sent home and have through the kind offices of one of the leading European firms in India, been technically reported on. The result of the analyses is shown below; and it may reasonably encourage further efforts to establish the soy bean as a commercial and technical crop.

The samples in question were supplied by the Director of Agriculturé, Bombay, and were grown from seed of Japanese origin at the Manjri Experimental Firm.

ANALYSES OF FOURTEEN SAMPLES.

Sample No.	Moisture per cent.	Oil per cent,
2	11·31	16·80
3	11·18	19·42
5	10·86	20·28
6	11·12	19·12
7	11·00	19·30
8	10·93	19·34
9	11·21	16·44
10	10·75	20·46
11	9·90	22·48
12	11·74	17·26
14	11·15	20·36
17	11·37	21·22
18	12·06	19·18
19	11·28	21·95

The crusher to whom the samples were submitted added the following comment:—

"Eleven of the fourteen samples are, in our opinion, distinctly good, and those showing above 20 per cent. oil very good indeed and better in this respect than the best Sakura Manchurian beans. No. 11 (the best resultant) we are analysing fully for albuminoids, but shall not have the result for a few days. We beg to add that the Manchurian soy beans contain on an average about 19½ per cent. oil, of which about 6 per cent. is left in the cake.

"The present value of Sakura beans (with 1 per cent. franchise for admixture) is £6-12-6, and for Harbin beans (with 2 per cent. franchise for admixture) £6-10.

"We will forward to you the full analysis of sample No. 11 as soon as we receive it."

For purposes of comparison we give below the range of oil content quoted

by the Reporter on Economic Products in respect of seeds of diverse origin :—

Chinese beans	17·60 to 26·18
Japanese ,, ...	13·36 ,, 25·55
Java ,, ...	18·37 ,, 26·18
Grown in Europe	15·16 ,, 21·89
Grown in North America ...	18·42 ,, 19·52

We also append a note of an analysis made last July by the Office of the Reporter on Economic Products for this Department with reference to a sample of Manchurian beans obtained in the London market by the firm to whom our acknowledgments have already been expressed :—

CHEMICAL EXAMINATION OF MANCHURIAN SOY BEAN REG. NO. 31337.

	Per cent
Moisture	13·6
Oil	17·7
Ash	5·1

From this comparison it is apparent that while the oil content of the Indian samples recently examined falls short of the highest percentages recorded in respect of seeds from some other countries, it compares well in some instances with the percentage found in the Manchurian seed.

The yields per acre obtained in 1906-07 on various plots at the Manjri Farm were as follows :—

No.	lbs.	
5	1,166	This plot bordered on black soil.
6	513	
7	650	
12	575	
13	395	
Average	660	

PINEAPPLE GROWING IN BATAAN AND BULACAN PROVINCES.

BY MARIANO M. CRUZ,
Agricultural Assistant.

(From the *Philippine Agricultural Review*, Vol. II., No. 9, September, 1909.)

The Pineapple (*Ananassa sativa* Lindl.) has never been, and is not as yet, commercially grown in the Philippines. It is true that it is well adapted to most places in the Archipelago where the soil and climatic conditions are so similar to those of its native place in South America. Unfortunately it is grown only to supply the home consumption of the fruit and the demand for the cloth that is made from its fibre. Of course there is some of this cloth exported annually, but this amounts to only about P1,200.

PRODUCTION OF FIBRE AND FRUITS.

In 1903 there were in all the Islands about 613 hectares of land devoted to pineapple growing, from which about 952,400 pines and 292,400 kilograms of fibre were taken, giving an average production of 1,500 fruits and 470 kilograms of fibre per hectare. The provinces in which the yield of fibre amounts to 15,000 kilograms or over are grouped, with reference to the amonnt of fibre produced as follows :—

Order.	Provinces.	Area cultivated (hectares).	Fibre produced (kilos).	Average per hectare (kilos).
1	Negros Occidental ...	41	46,600	1,122
2	Samar	51	30,229	593
3	Bulacan ...	31	18,400	594
4	Cebu ...	25	17,296	692
5	Leyte ...	29	17,086	589
6	Laguna ...	25	15,772	631
7	Batangas ...	27	15,114	560

The following table shows the Provinces in which the yield of fruits amounts to 20,000 and upward :—

Order.	Provinces.	Area cultivated (hectares).	Fruits produced.	Average per hectare (fruits).
1	Samar ...	51	93,000	1,824
2	Bataan ...	30	46,620	1,554
3	Negros Occidental ...	41	44,400	1,083
4	Tayabas and Marinduque	41	42,000	1,024
5	Cebu ...	25	31,200	1,246
6	Leyte ...	29	25,700	886
7	Bulacan ...	31	24,900	803
8	Zambales ...	12	22,700	1,892
9	Cagayan ...	17	21,300	1,253

In the Philippines, Luzon stands first in the list of all the pineapple-producing islands, having more than one-half of the total area and fruit production, while it produces about 46 per cent. of all of the fibre.

LEADING PINEAPPLE DISTRICTS.

Some time ago I visited two of the leading pineapple districts in Luzon, namely, the towns of Orion and Bulacan in the Provinces of Bataan and Bulacan, to make a study of the pineapple cultivation in these places. These two provinces being situated near the coast of Manila Bay their most important industry, of course, is fishing. While it is true that fishing is often very profitable, yet it is somewhat uncertain, like gambling, and not all people can depend upon fishing for their living. The leading residents in these places are anxious to find the best means for fully developing their farms. It was suggested to me, owing to the fact that many of the

farmers are not able to understand either the Spanish or the English publications of the Bureau of Agriculture, that it would be well to hold an occasional convention in the provinces, similar to farmers' institutes in the United States, so that the farmers would be put in direct touch with men trained in the science of agriculture.

The chief agricultural products grown at Orion are, in their order of importance, rice, pineapples, and corn; while in Bulacan they are rice, sugar cane, pineapples, and ylang-ylang; so that, generally speaking, we can classify the pineapple industry as third in rank of all the industries of these two places.

Orion.—In going over Orion, which is the chief pineapple-producing town in Bataan, I found a whole barrio devoted to pineapple growing—that is, the barrio of Damlog situated on the south side of the town—while some other sections of the town, like that on the west, may be equally adapted to the pineapple industry. Since the insurrection in 1896, the barrio of Damlog had been entirely abandoned by the people who once inhabited it, so that the first pineapple plantations which were established there some five scores of years ago by a Spanish military sergeant, are now almost a jungle left to the mercy of wild pigs and rats.

Bulacan.—In the town of Bulacan pineapples are grown principally in the barrios of San Nicolas, Balubad, Tibig, Pitpitan, and Tabang. The conditions here are somewhat different from those in Orion, due to the fact that better care is given to the plantations here where people live nearer to their plantations than the people in Orion. In both places only a few people are opening up new plantations, and the old plantations are not cultivated or fertilized as they should be, and therefore produce but little each year.

INDIVIDUAL PLANTATIONS.

The size of a pineapple plantation in the places I visited ranges from 10 to 50 ares, giving an average of about 30 ares (0·3 of a hectare) for each plantation. However, each of the principal growers in both provinces, namely, Sr. Mariano Grei y Angeles, Sra. Pelagia Estacia, Sra. Romana Labrador, and Sr. Teodorico Tria in Orion, and Sres. Edeudato Lava, Francisco Fernando, Manuel Catindig, Jorge Tablan, Anastacio Rodriguez, Francisco Baltazar, and Sra. Isidora Serpio in Bulacan own much larger tracts of pineapple land.

VARIETIES.

The variety of pineapple that is now raised in Orion has a much larger fruit but is not so sweet as the Bulacan variety. In Bataan the leaves are not used for their fibre as is the case in Bulacan, and the Bataan pineapple, that is said to have been introduced from Bulacan, has apparently been producing larger fruits at the expense of the leaves. Another kind sometimes found in Bulacan is a mestizo variety about the size of the red Spanish. The existing varieties of pineapples in the Philippines, including the Marinduque variety, are supposed to have sprung from pineapples that were introduced from South America by the Spaniards more than a hundred years ago.

METHODS OF CULTIVATION.

On examination of the number and kind of plants in the field, we noted that the plants were set out without leaving any space for a pathway between the rows, and that after each plant had produced its full number of rattoons, suckers, and slips, it rendered the harvesting of the fruits amongst the thorny leaves a most difficult task for the farmers. During the harvesting they often chop off the dead leaves and the miniature plants above the soil. This of course serves to thin out the plantation; but as these young plants which are left in the ground grow very thick, the plantation may again be turned into an impenetrable field before the next year. The fact that only from 40 to 60 per cent. of all the plants bear fruit each year shows not only the effect of close planting, where each plant grows at the expense of the other, but also that selection for the most productive mother plants is not well put into practice. The lack of proper selection and cultivation are also evident in that the plants produce fruits of such varying taste and size (from 0·69 to 1·61 kilograms each). However, it is safe to say that the Philippine pineapple is almost free from any pest or disease, save from what is commonly known as "tangleroot." The leaves produced are from 8·34 to 18·07 decimeters long, but it is to be regretted that the fibre from the leaves is not as yet much used for textile purposes. The leaves of plants after maturing their fruit usually produce one or more suckers, and not merely become waste but a source of danger from fire. The present method of extracting pineapple fibre is merely by scraping the fresh leaves with a sharp knife or a broken piece of glass, leaving the fibre in a clean condition to be dried in the sun,

SEASONS FOR PLANTING AND HARVESTING.

The planting season in the Philippines is during the months of July and August. The young rattoons and suckers are gathered from the old plantations and planted in a clay-loam soil about 5 to 7·5 centimeters deep and from 60 to 80 centimeters apart. At the time of planting such fruit trees as the "lanca" (*Artocarpus integrifolia*), "guayaba" (*Psidium guayava* L.), "santol" (*Sandoricum indicum* L.), "mabolo" (*Diospyros discolor* Willd.) are set out to shade the new plantation. About 40 to 60 per cent. of the plants bloom during the months of February and March of their second year of growth, and the fruits are harvested in the months of May, June, and July. In most provinces the fruits are consumed in the locality where they are produced, but in Bataan and Bulacan the product is sold to local dealers who in turn ship it to Manila for sale in the raw condition. Commercially speaking, none has yet been prepared or canned for home consumption or for export. The fruits are usually sold without even being graded for size and quality, all of which means a reduction in the selling price.

ESTIMATED EXPENSE AND INCOME.

The following estimate of the expenses and the income from a pineapple plantation of one hectare was given me by some of the growers. This will give prospective investors an idea of the present cost of production and the annual receipts from one hectare of land planted with pineapples.

Expense or capital invested.

1. Average cost of a hectare of land (P150 to P300) ...	P225·00
2. Tools, "dulós," a spatula-like bolo, and a bolo	5·00
3. Cost of clearing of brush and timber land	30·00
4. Cost of planting (20,836 suckers), at P2 per 1,000 ...	41·67
5. Cost of harvesting 10,417 fruits, at P1·50 per 1,000 ...	15·63
6. Tax, at six-eighths of 1 per cent of the land value, for two years	3·36
Total ...	320·66

INCOME.

From 40 to 60 per cent. of the 20,835 plants will produce about 10,400 fruits, which sell at from P3 to P5 a hundred, giving a total income of at least P416 for the first year. This shows that for the first year of production the returns are much greater than the total expense or the capital invested; while for the succeeding years the only expense would be for cultivation and harvesting, which when intelligently carried on with the judicious use of fertilizers would give a continual increase in the income of the grower.

SUGGESTIONS.

With an industry which has received so little attention it would seem proper that some elementary directions be given for the improvement of the Philippine product.

Selection.—We must resort to proper selection or crossing of the individual plants to obtain a greater number of bearing plants, say not less than 80 per cent., to raise larger fruits, not less than 1·38 kilograms, and at the same time a better quality of fruit. Of course to maintain such desirable characteristics we must give the field proper cultivation and use of fertilizers.

Cultivation.—In the way of cultivation, hoeing can be done three or four times a year, enough to stir the surface of the soil around each plant to hold the moisture as well as to kill the weeds. In the first place, a sandy soil should be selected as it is usually free from obnoxious grasses and it forms a desirable bed for the pineapple, owing to its great looseness and porosity. The superfluous leaves, rattoons, suckers, and slips should all be destroyed, unless the rattoon or the lowest sucker must be saved to take the place of the mother plant. Good cultivation will act as a remedy to the disease known as "tangleroot," which is characterized by the roots growing round and round the stem or tap root in search of food instead of reaching out into the ground. Of course, to facilitate hoeing and cleaning, an ample space between the plants should be allowed, for instance, about 80 centimeters between the plants in rows about 120 centimeters apart.

Fertilizers.—At the end of a period of about eight years the old plantation must be all cleaned and ploughed under with some manure or fertilizer to restore the elements which have been taken from the soil. It has often been said that our soils in the Philippines are very fertile, but "Where does their fertility go to?" It often goes to waste without farmers paying any attention to returning it to the soil. It has been found by scientific agriculturists that an application to the soil of the proper kind of fertilizers containing nitrogen, potassium, and phosphorus in the necessary proportions will improve the fruit or the plant, and sometimes both, and thus

increase the market value of the product. It is therefore necessary for Filipino pineapple growers to apply fertilizers to their soils so as to provide them enough of the necessary plant foods for their proper development. Pineapple fields should be given at least two applications of fertilizer each year. The plants should be fertilized the first time immediately after their fruits have been harvested, and again about two months previous to blossoming. The last application should contain a large amount of potash to improve the quality as well as to develop the size of the fruit.

The following composition is taken from Bulletin No. 8 of the Porto Rico agricultural experiment station, and shows the necessary elements and the amount of such mixtures which should be used for every 1,000 plants. A sufficient quantity of tobacco dust should be dropped into the heart of each plant; the tobacco serves as an insecticide as well as a fertilizer. The application per 1,000 plants following the harvest should consist of about 19 kilograms of dried blood, 14 kilograms of high-grade sulphate of potash, and 13·34 kilograms of acid phosphate; while the second application may be made of the following combination: 18·4 kilograms tankage, 22·08 kilograms of low-grade sulphate of potash and 5·98 kilograms of basic slag.

Canning Factories.—The desire of many people to establish pineapple-canning factories in Manila must be known to the growers so that the latter can be induced to produce fruits of a desirable size and quality for shipping purposes. There is also a demand, from some firms in Manila, for pineapple fibre, and the planter might just as well take advantage of this product which is usually left in the field to decay.

PINEAPPLE PRODUCTION IN OTHER COUNTRIES.

Before closing this article, we must take a glance at the situation in the principal pineapple-growing countries of the world in order to realize the true importance of the industry. Let us look first at the United States and one of her island possessions, Hawaii. The State of Florida produces annually about 15,000,000 fruits; while in Hawaii, where planting of pineapples has just been started, it is estimated that 4,560,000 fruits will be produced in 1910. To take care of this product, Honolulu, the capital of Hawaii, has established a canning factory that is claimed to be the largest in the world, with a capacity for canning about 132,000 fruits every day. At present, Singapore produces the most pineapples, supplying nearly all England and the European Continent with an annual export of about 20,313,424 canned fruits. The variety that is most extensively grown in the places mentioned above is the "red Spanish," while the other varieties raised are the "Abbaschi," "smooth Cayenne," "Porto Rico," and "Natal canning." Some of these varieties are now being tested at the Government experiment stations along with our native varieties. With favourable soils and climatic conditions, with a growing interest and enthusiasm on the part of Filipino farmers and business men for improved methods, we could soon place the Philippines side by side with the places above mentioned, in supplying the world's demand for pines.

SUGAR GROWING AND MANUFACTURE IN NORTHERN INDIA.

(From the *Agricultural News*, Vol. VIII., No. 190, August 7, 1909.)

The following article, from the *Agricultural Journal of Northern India*, Vol. IV., Part 2, gives some facts in connection with the sugar industry in Northern India:—

Several attempts have been made in recent years to manufacture white sugar direct from sugar-cane as is done in the West Indies, Egypt, Mauritius, and other sugar-growing countries. Considerable capital has been invested in these undertakings, the best up-to-date machinery imported from Europe, and skilled Europeans with expert knowledge, commercial, technical and scientific, have been employed. In spite, however, of what would appear to be most favourable auspices, careful supervision, and a very large demand for the manufactured article, none of these undertakings have so far achieved more than a very moderate success, and most have had to face serious pecuniary loss.

At first sight, no country in the world would appear to offer a better field for the cane and sugar industry than India. The consumption of sugar by the inhabitants of this country is enormous, and upwards of half a million tons of sugar are imported into India annually. Why then has the sugar-making industry not made better progress? Various causes have contributed to handicap these pioneer efforts. Although sugarcane has been grown throughout Northern India for some 2,000 years, the quality of the crop has never been as high as in other cane-growing countries,

either as regards the weight of cane grown per acre, or the sugar content per 100 of canes.

The Indian cultivator at his best is hard to beat, although his methods and implements may appear primitive to western agriculturists. He is quick to adopt improvements in cultivation and seed if he is satisfied that they will increase his profits; but in the growing of sugar-cane, he is faced with two serious problems. The soil has been exhausted by many centuries of continuous cropping, and the supply of suitable manures at a moderate cost is very limited. A greater difficulty still is the climate. The annual rainfall, though usually sufficient in quantity, is badly distributed throughout the year, being concentrated into a few months, followed by many months of extreme dryness. These two causes, however, would not alone be sufficient to account for the indifferent success of large central cane factories; fresh sources of manure can be discovered, and the short period of growth, due to the concentration of the rainfall, can be mitigated by carefully thought-out schemes of irrigation.

The Indian cane factory has against them, on the credit side, the saving in manufacturing losses by a continuous process, and the economy in freight and transit charges by having a ready market at the door. The greatest difficulty, however, with which a central cane factory has to contend is the nature of Indian land tenure, by which the country is split up into a multiplicity of small holdings, and this seems to be an insuperable one. The effect of this system of cultivation in innumerable small farms is that concentration of crop round the factory is in most instances impossible. The cane is grown in small isolated patches, and in order to feed a large factory, it has to be collected from a very large area radiating many miles from the factory, with all the consequent heavy cost of handling and carrying entailed in dealing with a commodity so heavy and bulky as raw sugar-cane: this, combined with the inevitable deterioration and loss of sugar by inversion during the period of transit from the fields to the mill, more than counterbalances the benefit gained by the continuous process. It would seem, therefore, that central sugar factories can only be profitably worked, if at all, in canal colonies or large zamindaries where a concentrated area is available under the personal control of the owner or planter.

If the sugar industry in India is to hold its own against the foreign importer, development will have to be along the line of intense cultivation by the grower, to increase the outturn of sucrose per acre, and improvements in the making of raw jaggery or *Gul* by the villager, preventing the heavy losses by inversion and adulteration entailed by the crude methods at present employed. If this can be done, the Indian refiner will have nothing to fear from foreign competition in India, and may even in time be able to export to other markets, if not barred by prohibitive protective duties.

TIMBERS.

STANDARDISATION OF TREE MEASUREMENTS.

(From the *Indian Forester*, Vol. XXXV., No. 11, November, 1909.)

There is a considerable amount of confusion in the matter of the measurement of trees in India and Burma, and it is a matter for regret that definite rules on the subject were not formulated when the Forest Department was started. We wish to draw attention to this most important subject in the hope that definite rules will be drawn up and adopted generally for the future.

In the first place, there are two systems ordinarily in vogue for the classification of trees; one by girth classes and the other by diameter classes. For the former, classes of 18 inch periods are usually adopted, and for the latter, classes of 6 inch periods. Thus for girth classes it is usual to speak of trees measuring less than 1½ feet in girth at breast height as V class trees, those above 1½ feet and up to 3 feet as IV class; those above 3 feet and up to 4½ feet as III class; those above 4½ feet and up to 6 feet as II class, and those above 6 feet in girth as I class. It is equally common, when reference is made to trees classified by diameter measurements, to speak of trees up to 6 inches in diameter at breast height as V class trees, trees above 6 inches and up to 1 foot in diameter as IV class, trees above 1 foot and up to 1½ feet as III

class, trees above 1½ feet and up to 2 feet in diameter as II class, and trees above 2 feet in diameter as I class.

It thus comes about that I class trees are loosely referred to as being either above 6 feet in girth or above 2 feet in diameter, as if these measurements were synonymous. An instance in point occurred a few years ago in an important working-plan. The enumerations were done with callipers graduated for 6 inch diameter classes, and the results obtained were treated as girth classes and the prescriptions made accordingly. Owing to this, trees in the first coupe above 6 feet in girth which were found available for felling were 2,000 more than the number expected, for the change from diameter to girth classes really brought more than one-sixth of the trees shown in the enumerations as II class according to diameters into the I class according to girths, *i.e.*, above 6 feet in girth.

Again, the classes mentioned above have practically become, throughout India, standard classes of measurement, and it only remains for it to be decided whether girth classes or diameter classes are to be adopted for the future. Thus, almost all forest officers if asked what a I class tree was, would say it was a tree measuring over 6 feet in girth or over 2 feet in diameter; some would say the one, some the other, and some, speaking loosely, would speak of the two as synonymous. Thus, a class I tree is practically a standard size, differing only within the above limits. This being so, it is very confusing to find that in some cases trees of other sizes are called I class, and so on. For an instance we refer to page 571 of the October number, where the classes adopted are quite different. Any one after reading the article on this page would, on turning to page 588 of the same number, be puzzled to know what is meant by a III class tree in the last sentence of para 11.

It is therefore, we consider, most advisable that definite standard classes should be fixed so that it will always be known what is meant by a I class tree, II class, and so on. In our opinion girth classes are the most suitable, for the sections of trees are seldom circular, and it is a matter of some difficulty to ascertain the exact average diameter of a tree, whereas the exact girth can always be easily ascertained. By this we do not mean that all measurements of trees for marking, etc., should be done by tape. It is easy to have callipers graduated to correspond to the diameters of the 18 inches girth classes, and it is usual in practice when using callipers to measure each tree in two directions at right angles. We have found it quite accurate, if it is found that a tree, measured in both directions, falls to the same class, to record it as belonging to that class, but when the measurement in one direction locates a tree in one class, the measurement in the other in another class, we found the simplest way to decide the right class was by girth measurement with a tape. We recommend that the girth classes given above be now officially adopted as standard classes, so that in future there will be no doubt as to what is meant by a I class tree, II class, and so on, and as these clasess are already generally known and used, it would be simpler to adopt them than to lay down a revised scale of classes together.

Of course we recognise the fact that for many working-plans and other purposes, the standard classes would not be sufficient, as it is often necessary to discriminate between the sizes of trees above 6 feet in girth and to differentiate in more detail between smaller trees. For the latter, subdivisions of the standard classes will generally suffice, but for all other divisions from the standard classes we recommend the adoption of letters to indicate that the class referred to is a special one. Thus, in cases where a minimum exploitable size of above 7½ girth is adopted, the class above 7½ feet in girth might conveniently be termed M. class, meaning mature, or by any other appropriate letter. Any officer coming across the mention of an M. class tree for the first time, would at once enquire what it meant and no confusion would arise.

The question as to the height at which the girth measurements should be taken is more complicated, for on account of some species developing large buttresses, they cannot be measured at the usual breast height which is generally taken to be 4½ feet above the ground. For practical purposes it will probably be sufficient for the girths to be taken as they are now at breast height where there are no buttresses, and as near above that as the buttresses will allow, if there are no buttresses, except when the buttressed portion is utilised, in which case a correcting factor might possibly be adopted. This matter is one on which some enquiry is necessary before standard rules can be decided on.

At present in India, so far as we are aware, there are no height classes in general use, and it may be argued that as there are so many different species to be dealt with, it would not be of much

use to have standard height classes laid down. We, however, are of opinion that it would be most advantageous, and we suggest that a suitable standard scale of height classes be drawn up and prescribed officially at the same time as that for girth classes. Height is the most reliable indicator as to quality of soil, and once the standard height classes were adopted, it would in time lead to the classification of soils by the height class attained by important species at different ages.

We trust that this important matter will now receive the attention it deserves, and, if standard classes are adopted, we recommend that the details concerning them be included in the revised edition of the "Glossary of Technical Terms for use in Indian Forestry." It might even be possible to include, from time to time, any special classes indicated by letters, as proposed above in the glossary by means of adenda slips, indicating the area in which the special classes are in force. In this way all confusion would disappear, and in a few years the standard girth and height classes would be definitely known and adopted throughout the Indian Empire.

WOOD PRESERVATION.

GERMAN AND FRENCH PROCESS.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 9, September, 1, 1909.)

Various methods of applying preservatives to rail-road ties and telegraph poles have been in practical use in Europe for more than twenty years. It would be difficult to find in any advanced European State a single railway, telegraph, or telephone line the tics and poles of which have not been impregnated with an antiseptic composition. Figures are published relating to twenty German telegraphic lines, the impregnated poles of which were set at various intervals from 1877 to 1893. Of those set in 1877 about 35 per cent. were still sound and in use after twenty-six years' service, and of those set from 1891 to 1893 there are records of five lines upon which all the poles are still standing. The American Consul-General at Hamburg says that the Bavarian postal service, after thirty years' experience, certifies that the known average life of impregnated poles in Bavaria is seventeen years and a half and the German Imperial Administration calculated, in 1903, that the known average life of such poles was about sixteen years. In the meantime the work of impregnation is being more perfectly performed, so that future statistics will show better results. In France, the Eastern Railway Company announced, in 1889, that in the twenty-four years preceding 67 per cent. of its untreated oak ties had been replaced, while only 16 per cent. of such as had been treated with creosote had been removed. Beech ties properly impregnated, according to the Chief Engineer of that Railway, have an average life of thirty-five years. More recent conclusions reached in the same system were to the effect that 80 per cent. of creosoted beech ties were good after twenty-seven years of service, while only 51 per cent. of oak ties treated in exactly the same manner were good after twenty-four years of service. The results of impregnation appear so conclusive and undisputed that it would be futile, says the Consul, to present further details on the subject. In recent years the most useful preservative agents in use have been chloride of zinc, creosote and bichloride of mercury, applied by imbilition, or by impregnation by injection forced by the pressure of the air.

This second method of treatment generally consists in placing the wood in closed metallic recipients from which the air is pumped, and the liquid then introduced under high pressure. Until comparatively recently, it was very common to treat wood by injection under pressure of chloride of zinc, diluted with water. While this antiseptic is efficacious, it loses its qualities and becomes hygroscopic. To overcome these disadvantages, creosote was added to the mixture, and under the title of "mixed impregnation" this system has been adopted for the treatment of white wood ties which are too cheap to warrant the use of creosote alone. Hard wood ties, on the other hand, are impregnated with creosote alone, the general effect of which is to close the pores, coagulate the sap, and kill the micro-organ-wood. The use of creosote alone is quite unusual in the treatment of telegraph and telephone poles, because of odour, tendency to melt and run under the sun, and objection raised by the men employed to deal with them. It is common therefore to use bichloride of mercury (the French Government use sulphate of copper), the efficacy of which has been known since the middle ages, when it was used to arrest decay and the action of insects. At the Himmelsbach plant, near Freiburg, this is used in 66 per cent. solution. The wood is plunged into timber or cement receptacles, and there remains from ten to fifteen days. In this plant, moreover,

treated poles are given a special coating, of some unknown antiseptic, which extends about 2 ft. above and 2 ft. below the point where the pole enters the soil. This application protects the part where variations in humidity commonly attack the pole. In the Himmelsbach establishment there are tanks for impregnating forty ties at a time, under pressure; these tanks being about 65 ft. long, and over 6 ft. in diameter. Their baths for treating telegraph poles are 98 ft. in length.

PLANT SANITATION.

REVIEW.

The "Mosquito-Blight" of Tea. (*Helopeltis theivora.*) Investigations during the cold weather season of 1907-1908.

"Mosquito-Blight." Report on Experiments during Season 1908 at Rampore and Koombergram Tea Estates.

BY C. B. ANTRAM, F.E.S.,

Entomologist to the Indian Tea Association.

These two circulars, issued by the Indian Tea Association, were published in 1908 and 1909 respectively, and detail the results of Mr. Antram's investigations into and experiments upon the treatment of this most important tea pest. In his Preface to the first circular, the author states that he has "purposely refrained from giving the life-history of the Tea Mosquito in any great detail, as many matters relating to the insect have seen so thoroughly gone into and thrashed out in the last few years, that to do so now would be to go over much old ground." He further remarks that he has contented himself "by touching only upon those points that have been left undecided, and by giving particulars of the latest discoveries and observations made in connection with the life-history and habits of the insect during special investigations carried out in the past season, and in particular the cold-weather of 1907-1908."

Although our local Tea-bug (I use this name in preference to the misleading term Tea-mosquito) *Helopeltis antonni*, is considered to be specifically distinct from its Indian ally, the appearance and habits of the two species, and their effect upon the tea plant, are so similar, that we—in Ceylon—may take advantage of Indian experience, with modifications necessitated by the difference in cultural methods that obtain in this country, on which account I propose to quote at some length from Mr. Antram's valuable and interesting observations. In fact, my remarks will be more of the nature of a resumé than of a review.

The author estimates the pecuniary loss through the ravages of Helopeltis, in the year 1907, at ten lakhs of rupees. His observation that a low jat of China hybrid suffers most from the blight, accords with our own experience in Ceylon, where the difference in the severity of the attack upon different varieties of tea is most marked.

The first part of the earlier circular is devoted to a study of the habits of the insect during the cold weather months, which—according to the author—"have never been completely followed out until this last winter of 1907-1908. Previous pamphlets record observations mostly made during the time when the insect is most active, *i.e.*, at the height of the season, and hitherto very little has been found out with regard to how its life-cycle is affected by the cold weather."

Mr. Antram sets himself to solve the following important questions, apparently with complete success:—

1. "What became of the insect in the cold weather, and where did it hibernate if definite hibernation takes place?"

2. "How far is the life cycle affected by the cold weather?"

3. "How long do eggs take to hatch out in the cold weather, and do they lie dormant until shoots are developed on the bushes?"

With regard to the first question, he finds that there is no true hibernation, but that the "insects in all stages, from freshly hatched specimens to adults, could be found in large numbers on all blocks of differently pruned tea as well as on the unpruned. It was even quite easy to find specimens upon very hard pruned tea upon which there was hardly a vestige of leaf."

The answer to the second question may be quoted in full. "Eggs laid in November, December and January, owing to the low temperature at that time prevailing, take two and three times longer to hatch out than at the height of the season. The same applies to the larvæ which are very much longer in reaching maturity, or the winged

state during the cold weather months compared with the period passed by them in the rains. The term of life of the adult, on the other hand, to all appearances, is cut short during the cold weather, the insect not living so long at that time as during the height of the season. It has not yet been definitely ascertained how long it lives in this state during summer, but a few individuals kept in captivity at that time, in 1906, live for 2½ months and more."

Mr. Antram's investigations into the subject of the third question proved that there is a steady retardation of hatching out, commencing from the middle of November and culminating in the middle of January, after which there is a reverse progression of acceleration until the normal period of from eight to ten days is reached towards the middle of March. A chart shows the curve of retardation and accellaration plotted out to intervals of from one to three days. It is a pity that these intervals could not have been made regular; but the general tendency of the curve is quite clear, and it can be gathered from it that eggs laid in the middle of November hatched in from eight to ten days; by the 16th December the period had risen to fourteen days; from which date there is a steadily ascending gradient to the 13th January, when the period has increased to sixteen days; after a few slight fluctuations the maximum period of twenty-seven days is reached on the 20th of January. It will thus be seen that the maximum is just three times as long as the normal period.

By keeping a number of the insects under observation from the time of hatching until the date of attaining maturity, Mr. Antram has shown that there is a corresponding lengthening of the larval period during the cold weather months. The maximum period seems to have been reached by the middle of December, and to have remained fairly constant until the end of that month, after which there is a gradual reduction in the number of days spent in the larval stage. It is stated that, during the height of the season, the insect completes its transformations in from ten to twelve days. Incidentally, Mr. Antram has found that the insect "undergoes five moults altogether before reaching maturity or the winged state,"—a point in its life-history that had not previously been established in India. While the development of the egg and of the larval period is delayed by the cold weather, the length of life of the adult insect is somewhat shortened. But the total existence of the individual—from the time that the egg was laid to the death of the adult insect—is extended, during the cold season, to more than three months. "During the whole of that time the insect is active and feeding except on very cold nights in November and January when it would be sheltering inside the bush or in the jungle growing at the foot of the bush."

It has been known for some time that the Helopeltis insect does not—like so many insects—lay all its eggs within a short period after fertilization. Dissection reveals the fact that only a few fully formed eggs are ready for extrusion at any one time, though the ovaries are packed with undeveloped ova. But it is rather startling to find—as has now been determined by Mr. Antram—that a fertilized female may live for seven weeks and deposit, during that period. over 200 eggs. Indeed, one prolific individual, kept in captivity during the rains, laid nearly 500 eggs.

Another interesting fact, observed by Mr. Antram for the first time, is the actual manner of the laying of the egg. It appears that the insect first punctures the stem with its proboscis and then inserts its ovipositor into the hole so made.

The author of the circular then gives the results of his investigations as to the positions—on the tea bush and elsewhere—in which eggs are deposited, when the bushes are not flushing. He observes that eggs may be found in any of the following sites:—

"1. In the succulent stems, from the base of the first open leaf down almost to that part of the shoot which is not reddening into wood."

"2. In the midrib of leaves, both old and young, towards the base."

"3. In the tips of ruptured stalks where green shoot has been plucked off."

"4. In the tips of ruptured stalks where both old and young leaves have fallen off or have been broken off."

"5. At the base of minute developed and undeveloped buds in the axils of the leaves."

"6. In the stalks of flowers and seeds on the bush."

"7. On two different plants growing in the jungle."

He remarks that "it seems therefore from the foregoing that the insect has no trouble in finding places in which to lay her eggs under almost any circumstances and nothing sort of collar pruning or very hard pruning will do away with egg sites. It goes without

saying that such a procedure for dealing with the pest is out of the question."

Mr. Antram finds, by experiment that, failing young leaves, the adult insects are able to subsist upon fully matured leaves. The punctures are clearly visible, but the leaves "do not curl up or become deformed as in the case of young leaves." Insects kept entirely without food invariably died within two days.

The second part of the first circular deals with remedial measures, and it is this section that will be of the greater interest to tea planters in Ceylon. As I have the author's permission to make full use of his circulars, I quote the following passages without further comment.

"There are two methods of dealing with the pest, and that at the most convenient time of the year, namely, at the pruning season."

"It has been shown that those insects reaching maturity towards the end of the cold weather survive the rest of the cold weather, during which time they are laying eggs. It is these insects that are responsible for the countless number of insects which turn up later in the year and do so much damage."

"For the destruction of these the method is simple enough, and is brought about by the burning of all prunings while they are still green, the best method being to burn the prunings the same day they are cut from the bushes. The area pruned in one day should be cleared that same day, and no prunings allowed to remain on the ground or in the pruned bushes. If the pruned area can then be hoed over and thoroughly cleaned up immediately after pruning, this will do away with fallen leaves and bangy shoots that have been cleared out of the bushes. The leaves, etc., properly buried, cannot produce insects, as the latter are so fragile when just emerged from the egg that they would find it quite impossible to work their way through the soil to the surface."

In the case of very light prunings, if these can be hoed into the ground and completely covered by the soil, removal of the prunings for burning need not be resorted to. Conditions now are such that a cold weather hoe immediately after the pruning is clearly indicated, specially if spraying is to be carried out after pruning. When the area is clean and the collars of the bushes are free of weeds, the insecticide can be applied with greater economy."

"During these investigations, experiments have proved that insects will hatch from eggs in prunings lying on the ground up to fourteen days, or so long as the tops of the prunings are not absolutely hard and dried up. With heavy pruning the shoots remain fresh a long time, especially when lying in damp nullahs or on the shady side of bushes and edges of the jungle."

"Burning the prunings the same day they are cut from the bushes will, at that time, destroy all eggs laid by insects during the previous fifteen days."

"In the removal of prunings and the cleaning up of the area by hoeing as above suggested, together with careful thinning out in pruning of all useless twigs and 'bangy' shoots, it is only the eggs and some immature insects that have been dealt with. The next process is the treatment of the pruned bush by spraying, the object being to destroy all living 'mosquitoes,' whether immature or adult, that have been left behind on the bushes after pruning, and by the destruction of which further deposition of eggs will be prevented. Spraying must be carried out as soon as possible after pruning, as, if delayed, eggs will be deposited in the pruned bushes. We are now able to recommend an insecticide that is cheap and easy to use; three or four boys kept for spraying affected bushes all the year round will do a hundred times more than a large number of collectors."

"It was found, by careful experiment, that Kerosene Emulsion kills only those insects it comes in contact with at the time of spraying, and the presence of the material on the bushes does not prevent the insects from feeding on the sprayed foliage, neither has it the effect of stopping insects from laying their eggs in the bushes. More than this, the emulsion in no way prevents emergence of insects from eggs that have received the spray, and as conclusive proof, it was found that a number of eggs contained in shoots that had been dipped in pure kerosene oil produced young insects that lived to reach maturity."

"After long experiment, I have been successful in finding a solution which is equally as deadly in its action on the insect as Kerosene Emulsion, and at the same time can be applied at twice the rate per acre at one quarter the cost of the latter. In January last 'Primrose' soap 1 lb. and water 20 gallons was recommended as the composition of Soap Solution for Mosquito Blight, but since that date the 'Imperial' brand has been discovered to be in every way

as effective as 'Primrose,' but at the same time nearly half the price. The Imperial Soap solution is made as follows:—Dissolve 1 lb. Imperial Bar Soap in 1 or 2 gallons of water by boiling, and dilute to 20 gallons."

"Imperial Soap is an ordinary Yellow Bar Soap made by the Bengal Soap Factory in Calcutta; it has been selected on account not only of its superior insecticidal effect, but for its property of forming a clean solution which will not form sediment when left to stand, and therefore does not require to be kept stirred up, and which will readily pass through the fine Vermorel nozzle of the sprayer; other makes of soap having a tendency to form gritty deposits which choke the nozzle."

"The simplicity of the solution makes it very much easier to prepare and use than Kerosene Emulsion, nor has the soap any tendency to burn the bushes."

The solution should be applied at the rate of from 200 to 300 gallons per acre for each round of spraying, the cost of which application will be, for the larger quantity, a little over Rs. 2 per acre, as compared with Rs. 6 per acre for applying 150 gallons of Kerosine Emulsion."

"It is obvious that the thoroughness with which saturation of the bush can be accomplished with the least amount of labour and material must depend largely upon the style of pruning carried out before the spraying takes place. Thorough cleaning out of the bushes is an essential preliminary to effective treatment of this blight, and should, indeed, invariably form part of the method of cold weather cultivation on gardens liable to 'Mosquito." The amount of solution required to thoroughly saturate a well-cleaned bush is less than one quarter the quantity necessary for use on one full of small shoots and with its base choked with accumulation of refuse."

"As has been referred to earlier in these pages, experiments have shown that the supposition that Kerosene Emulsion is able to destroy the eggs is no longer tenable. Unfortunately the same applies to Soap Solution, therefore it makes it necessary to include at least two rounds of spraying, so that those insects present in the egg stage during the first round may be destroyed as larvæ by the second; the cheapness of Soap Solution making two or more applications possible."

"If, later on in the season, when the bushes are fuller of foliage, insects are beginning to appear and fresh punctures are seen in the flushing shoots, spraying should be carried out immediately, and the quicker the round of the affected area is completed, the better will be the results."

"Some of the advantages of using Imperial Soap Solution are:—

That it is the cheapest insecticide yet discovered for Mosquito Blight.

That it is exceedingly easy and simple to prepare.

That the solution need not be kept stirred up while using it, as no sediment forms.

That it does not wear out the spraying machines.

That it has no effect upon the young foliage of plants.

That plucking of leaf can be carried out two or three hours after application, or *i.e.*, as soon as the solution has dried on the bushes.

That, when applied during a drought, it makes the bushes flush exceedingly well."

The circular ends with an account of the jungle plants upon which the insect is known to feed in India. There are four of these:—*Melastoma malabathricum*, *Mœsa ramentacea*, *Eurya acuminata*, and *Jasminum scandens*. Mr. Antram has found Helopeltis breeding in the first two of these plants, and he very rightly recommends their eradication from the neighbourhood of the tea fields. *Melastoma malabathricum* is a common plant in Ceylon and is conspicuous by reason of its mauve-pink blossoms. Trimen gives "moist low jungle up to 3,000 feet" as its habitat. *Mœsa ramentacea* does not occur here, but a closely allied species—*M. indica*—is one of the most abundant shrubs in waste land. *Eurya accuminata* is common in "moist low jungle up to 2,000 feet," according to Trimen. It is not unlike the tea plant in appearance, and belongs to the same natural order, *Ternstromiaceœ*. We have several wild *Jasmines* in Ceylon, but *Jasminum scandens* is not amongst the number. In this country I have found *Helopeltis antonii* feeding upon and breeding in the succulent shoots of a species of Eugenia.

The second of the two circulars gives the results of experiments with the Soap Solution. These experiments were carried out, under practical conditions, on two estates.

The Manager of Rampore Estate, Cachar, reports:—

"Blight made its first appearance on the 8th of May, and spraying was start-

ed. Bushes here and there over the whole garden were slightly affected, and these were sprayed with Soap Solution, being thoroughly saturated, which was repeated after 7 to 8 days, the result being that the Blight disappeared from the busines so treated."

"Throughout the months of May, June, July and August, wherever blight appeared, it was sprayed with soap solution with good results. During September Blight began to show up in places where it had appeared before and had been treated with soap solution. The Blight during September and October was of a very malignant type, so much so, that although only in small patches it completely destroyed all signs of leaf. Spraying was continued, but it was found necessary to use 50 % more soap in the mixture. Wherever it was possible to give the bushes a downright thorough saturation followed by another washing after a space of 7 or 8 days the leaf came through."

" In conclusion, the soap solution was found to give as good results as other insecticides formerly used—with advantage of being less expensive. After a somewhat lengthy battle with Mosquito Blight the conclusion arrived at has been that it is quite impossible to eradicate, but that by continually worrying it the same can be kept in check, only appearing to do very serious damage when assisted by favourable conditions."

Commenting on this report, Mr Antram remarks:—"I think we may say that the experiment has been a success, in that, on the first appearance of the insect and punctures in the young leaves on individual bushes and on blocks of tea from the 8th of May, the immediate application of soap solution to the affected parts, carrying out complete saturation, resulted in the disappearance of the disease from the bushes so treated all over the garden."

"It will be noticed from the above report that, up to and including August, wherever the Blight appeared, it was treated at once and repeatedly with soap solution with good results, and I am confident that if measures are taken in time, *i.e.*, at the very first appearance of the insect, by going round a garden and spraying affected bushes and blocks of tea, the insect is unlikely to obtain the upper hand and leaf will be got from all blocks of the garden throughout the year. On my visit to Rampore at the end of October I noticed that the garden was practically free of Mosquito Blight. The very serious nature of the blight which suddenly visited many gardens of Cachar in September absolutely ruined a very large portion of the tea, and leaf was entirely stopped for the rest of the season. This, in a less or greater degree, might have happened at Rampore tea estate if it had not been for the methods of prevention that were carried out. In the Manager's report it is remarked that the attack at that time was of a very malignant type. For that reason we decided to use the soap solution stronger, and applied it to the affected areas most thoroughly, getting through the work as quickly as possible."

The report from the other estate (Koombergram) is as follows :—

" With reference to the results of experiments carried out here during August, Ssptember, and October, I may say that blocks Nos. 1 and 5 (which are on either side of Nos. 2 and 3, the sections treated with soap solution) have been practically closed up since the beginning of September, while Nos. 2 and 3 continued to flush throughout September and October. On block No. 8 the Mosquito had got the upper hand when operations were started, but I would like to mention the fact that after two applications of soap we got a little leaf off this section, although during the three previous rounds of plucking I did not consider it worth plucking. Whether this was due to the spraying or to some other influence I am unable to say."

Mr. Antram remarks on the above :— " At Koombergram, blocks Nos. 1, 2, 3, and 5 were blighted to the same degree and all giving some leaf when operations were started on Nos. 2 and 3. After application of Soap Solution to blocks 2 and 3 these improved while the others became worse. Nos. 2 and 3 were never closed througout the season, while the rest of the China portion of the garden was for several months."

"When I last visited Koombergram Tea Estate in November I noticed that the treated blocks, Nos. 2 and 3, had made more growth than the bordering numbers which had ıeceived no treatment, and the appearance of the treated area was in September and October far healthier than that of the untreated. Blocks Nos. 2 and 3 were giving quite a fair quantity of leaf at each round of plucking during those months, while the untreated China portion of the garden was closing. The results of

the experiment on these two, Nos. 2 and 3, comprising 58 acres only, were not expected to turn out better. Mosquitoes from the outlying untreated area must have been visiting them throughout the operations. Also the correct time for starting this work was long past and the insects had well established themselves when spraying was commenced in August."

The cost of these experiments, "without taking into consideration the initial cost of spraying machines," works out at Rs. 1·37 per acre. "In this work the two 'Standard' pumps. three 'Knapsack' sprayers and some watering cans" were used. "Five big boys were employed to each 'Standard' pump and two boys to each Knapsack sprayer. Two boys prepared the soap solution and smaller children with women supplied the water. The average number of acres done in a day with the above five machines amounted to eight. The Knapsack sprayers proved the cheapest and got over the ground quickest."

Subsequently, in a private letter, Mr. Antram informs me "that from practical work and observations it is not now found necessary to carry out spraying on the large scale suggested, just after pruning the bushes. In India, climatic influences kill off the insects in early spring, and if weather continues unfavourable for the insects, blight does no damage till late in the season. I find it quite sufficient to start spraying when the insects first appear and punctures show up on individual bushes . . . . By continuing application so long as fresh punctures appear, the blight can be kept in check throughout the remainder of the season, two to three applications generally eradicating it. Blight will appear in fresh places, and it is these that must be carefully looked for after the blight has once appeared on a garden."

These two circulars must be considered a valuable addition to the literature on the subject. If the results of this treatment continue to bear out the expectations of its inventor, Mr. Antram will have earned the gratitude of tea planters who have been battling against this—the worst of all tea pests—for so many years with such poor success.

Although our local conditions are somewhat different to those in India, the treatment would appear to be equally applicable in our case, and is well worth an extensive trial.

E. ERNEST GREEN.

MISCELLANEA: CHIEFLY PATHOLOGICAL.

BY T. PETCH, B.A., B.SC.

It is rather a difficult matter to invent popular names for fungus diseases,—at least, names which will distinguish any given disease from any other. "Root rot," for example, does not differentiate between several root diseases, even when the name of the host plant is added. "Root rot of tea" might mean the disease caused by *Rosellinia bothrina*, or *Ustulina zonata*, or *Poria hypolateritia*, etc. The mycologist knows diseases by the name of the fungus or other organism which causes them; and incidentally it may be remarked that an account of a disease which does not give the name or description of the fungus is not of much assistance to a mycologist, however learned it may appear. Attempts have recently been made to popularise a system in which the name of the disease is coined from the name of the fungus, but this nomenclature is neither "happy" nor distinctive. By this system, the root disease of Hevea caused by *Fomes semitostus* would be called "Fomose of Hevea," but since several species of *Fomes* will grow on Hevea, the name does not fulfil our requirements. It would seem that the planter must add a few Latin names to his vocabulary. "Pink disease," for the disease caused by *Corticium javanicum*, was sufficiently descriptive to enable dozens of planters to identify it. But it has been objected to because "there is more than one pink fungus," and it is proposed to remember it by the name *Corticium*. But this critic neglects to inform his readers that there is also more than one species of *Corticium!* If the Latin name is used, it must be the full name, *Corticium javanicum*.

As the market price of rubber is governed to some extent by its appearance, any departures from a uniform colouration are undesirable; consequently spotted biscuits are frequently sent in for examination and report. Clear red spots in rubber biscuits or crepe appear to be fairly common; the cause of these has not yet been ascertained. Another colouration has just been reported; in this case wet biscuits were covered with black spots, up to an inch in diameter, the discolouration extending right through the biscuit. These spots contained bacteria, together with minute particles of a black pigment to which the discolouration was due. It is probable that in this case the pigment was excreted by

the bacteria; several bacteria are known to produce black colouring matters in this way. These biscuits had been coagulated with formalin. In another case, the biscuits when held up to the light were seen to be mottled with dark brown patches. These were dark biscuits which had not been subjected to any hot water treatment. In many examples of dark coloured biscuits it will be found that the colour is due, at least in part, to a thin film of brown colouring matter on the under (?) side of the biscuit. In some cases, if the biscuit is sliced into two horizontally, a marked difference will be seen in the colour of the two halves, the upper half being more or less amber coloured, while the lower half, though of the same thickness, is dark, owing to the presence of this brown film. The presence of this film may be demonstrated more clearly by cutting a thin slice through the biscuit and placing it in chloroform or some other solvent under the microscope. As the rubber absorbs the solvent and swells, the film on the exterior shows up quite plainly. This film is composed of some amorphous brown substance whose nature has not been ascertained, usually with some yeast cells; and, as a rule, it is spread uniformly over one side of the biscuit. In the case of the mottled biscuits referred to above, the discolouration, which was quite superficial, was due to an abnormal development of this film, and most of it was collected in patches instead of being spread uniformly over the surface. Yeast cells were present in abundance in the sediment obtained on dissolving the rubber in chloroform or carbon bisulphide.

Bacteria and yeasts appear to be the chief organisms concerned in this spotting of rubber biscuits; of course, moulds grow on the surface, but I have not up to the present observed any effect which could be attributed to them. An exact investigation into the causes of these spots would occupy one or more investigators for at least a year, and would require all the appliances of modern bacteriological research. It would demand a strictly scientific examination, in each individual case, of the fungus and bacterial flora of the collecting cups, the setting pans, the curing house and the water supply, together with experiments to determine which of the organisms found would grow in latex or wet rubber, and their effect on either. But although this problem cannot be dealt with under the present circumstances, it is possible to lay down more or less general empirical rules as to the course to be adopted in order to get rid of the cause of these brown or black spots. It is unlikely that the effect is in any way connected with the tree, and it must be assumed for the present that some organism is introduced into the latex or the coagulated rubber either by the wind or by the water supply. In either case, if the collecting cups, pails, etc, are once infected, they will remain infected, and the biscuits will continue to be discoloured, until some method of sterilisation is adopted. Therefore, when this trouble makes its appearance, all collecting cups should be boiled, and the dishes, pails, etc. scalded with boiling water. It has been found sufficient to do this once, but it would be a wise precaution to scald the dishes and pails periodically, as part of the general routine of the factory. In one instance, that of the mottled biscuits referred to above, this treatment was adopted; and the superintendent writes: "With reference to the black biscuits about which I wrote to you some months back, it may interest you to know that since I took your advice and boiled all the utensils used, and had my store thoroughly cleansed, no black biscuits have put in an appearance."*

If the infection is introduced with the water supply, the above treatment will not stop it, because the dishes will be reinfected. To determine whether the water supply is at fault, biscuits should be made, using water which has been boiled and cooled, and these should be compared with biscuits made with the unboiled water. Of course, the dishes, etc., must be sterilised before the experiment is attempted, otherwise that possible source of infection will not be excluded. If the water were infected, and no other source of supply were available, more elaborate experiments would be required to determine whether the infection could be avoided.

As an instance of a similar problem the following may be quoted. In a certain glue factory it was found that the glue turned black; and its value was seriously reduced, not only because of the undesirable colour, but also because its setting power was diminished. This was found to be due to a bacterium which excreted a black pigment. The source of infection was discovered in a dirty pipe previously used for the conveyance of ditch water, and afterwards for delivering the finished glue into the setting pans. When this pipe was cleansed the evil disappeared entirely. In such cases, the removal of the source

* Since the above was written, I have been informed that this blackening has reappeared.

of infection is usually an easy matter, once it has been discovered, but its discovery often entails elaborate and carefully planned investigation.

It may be noted that none of the discoloured biscuits referred to here were in any degree "tacky."

In issuing circulars on plant diseases, the avoidance of lengthy correspondence is one of the objects sought to be attained. It sets free more time for investigation when the Mycologist can reply: "This is a case of pink disease; see Circular 21." Such a reply may appear discourteously abrupt, but the knowledge that it enables more research to be undertaken should ensure its ready acceptance. But it is rather surprising to receive, in reply, payment for the Circular named, with the information that the applicant does not subscribe to them. It is surely not too much to expect that all estates should file these Circulars for future reference. It would be more satisfactory if the subscription were paid by the estate, as that would ensure a complete file in the estate office, independent of any change of superintendents. It is hoped to reduce the clerical work by the publication of brief leaflets which can be given away in answer to correspondents, but it is the common experience that such leaflets are soon lost.

Yet another growl. All letters relating to the diseases on any estate should be filed for the information of future superintendents. A folded sheet of brown paper, labelled "Diseases," is all that is required. In the majority of cases, at present, the new comer knows nothing of the past history of the estate in the matter of disease. One such instance may be given here, that of an estate which has changed its superintendent fairly frequently during the last four years. In 1906 *Fomes semitostus* was reported from this estate; it was visited, and all the affected areas were defined. Yet each succeeding superintendent has sent in examples of *Fomes semitostus* as a new disease. When this is possible, there is a screw loose somewhere in the method of dealing with the estate correspondence.

LIVE STOCK.

SELECTION IN THE BREEDING OF ESTATE ANIMALS.

(From the *Agricultural News*, Vol. VIII., No. 194, October 2, 1909.)

At the present time much is being written about the beneficial results of careful selection in the production of better strains of plants, such as corn, cotton, fruits and sugar-cane. The general principles of selection are fundamental, and may be applied with success to the breeding of animals, such as cattle for beef, for milk production and for draught, horses for draught or for speed. Donkeys, mules, sheep, goats, rabbits and poultry may all be improved by careful selection of the parents, by the use of good judgment in fixing upon the desirable characters, and in rejecting, as far as possible, all others. Selection as a process for the improvement of plants is beginning to be understood in a general way in the West Indies, and it might be well if certain points were brought forward for consideration in connection with the improvement of estate animals by this means.

On most estates in the smaller islands cattle are maintained only for purpose of draught, and the milk and butter needed are obtained from such cows as happen to be in milk. The animals used for beef are generally imported, or are estate animals which have not been raised as beef animals. On other estates, a point is made of the production of milk for sale. For each of these lines of work, different points would have to be selected, and it would be necessary, before starting out, to fix a definite system, and always to select with a view to the continuation of the same desirable points from generation to generation.

In the first place, whatever line is decided upon, the parents must be good animals of their kind. It hardly needs to be stated that poor, scrubby, undersized, weak animals are not suitable for breeding purposes. On many West Indian estates it would be possible to maintain cows for breeding only. They should be well fed, and kept in good condition. Estates which buy, on the average, ten working cattle every year might well keep ten or twelve selected cows as breeders. Most estates would keep a bull for breeding only. If these cows and the bull possessed the qualities which were most to be desired in the offspring, it will easily be seen that the estate would produce

its own supply of cattle of the type desired. All the offspring, male and female, could be trained for draught except a few of the best of the females, which should from time to time be selected for breeders. The males which have been bred in the herd should not be used as sires in the same herd, nor should the same sire stand at the head of a herd for more than three or four years at a time, except for the strengthening of certain especially desirable characters, and then care should be exercised not to weaken the animals in some other particular. The strength of the herd should be kept up by the periodical introduction of strong young males from other herds, whose animals possess in a marked degree the desired qualities. For general estate purposes, the Indian breeds of cattle, the Zebu and the Mysore, are especially adapted, since they are capable of making their greatest development, and of maintaining good health and vigour under the peculiar conditions of a tropical climate. They also provide the necessary size and weight for draught animals, and often develop good milking qualities.

It is well known that certain breeds are well established as beef, and others as dairy, animals. Under conditions of intensive agriculture, these two types are kept separate, for it has been found that the best beef animals are not often profitable for dairy purposes, and that the best dairy animals are not usually suitable for beef production. Many of these breeds have been introduced during past years, and cows possessing some of their characters in a marked degree may be easily recognised.

Dairymen find that, in addition to maintaining the desired breed characters, it is also necessary always to select for individual characteristics. The production of milk and butter is often an individual character, that is to say, the variation in these points is often greater between individuals of the same breed than between individuals of different breeds. The ability to produce large quantities of milk, or milk containing a high percentage of butter fat, is a characteristic which has relation to breed.

The amount of milk produced by any individual cow may be greatly varied by the quantity and quality of the food; but the quality of the milk, that is to say the percentage of butter fat, cannot be changed. It is a characteristic of the individual. The amount of butter produced by a cow may be increased by care and good feeding, but the increase in butter is a result of an increased flow of milk, and not of a change in the quality of the milk. The appearance of the dairy cow should be an indication of her milk-producing abilities, in the same way as the appearance of others would indicate their suitability for draught and beef animals.

A dairy cow should be able to convert food into milk and butter to the best possible advantage, while the beef animal should produce tender flesh, and the draught animal bone and muscle. It is obviously unwise to expect that the machinery—if the digestive and secretory organs of the cow may be so designated—which has for its object the conversion of food into milk should be expected to manufacture beef or muscle to the best advantage.

With regard to the qualities required on any given estate in the animals maintained for draught, the peculiar conditions on the estate should govern the selection. The size will naturally vary with the nature of the hauls; long pulls in which short, steep hills occur often are much better managed by comparatively small, wiry, nervous cattle, while long pulls on level ground and rough roads are often better done by heavier cattle with less nervous development. These are all points that should engage the attention of the estate owner, manager, or attorney.

More attention has been paid to selection in the breeding of horses than in that of cattle. Animals are chosen, because of their qualities, to produce offspring which should have all the desirable ones of the parents, possibly with some of them improved upon, or intensified.

The production of mules in the West Indies has not been accompanied by any systematic process of selection. Excellent sires have been imported, and when the limited number of mares available for this purpose is considered, it would seem that this is all that can be done. Much might be accomplished by selection in the matter of obtaining a better class of estate donkeys.

During the last few years a very considerable improvement in the local animals has resulted from the introduction of good sheep and goats. Many of these pure-bred and half-bred animals are not on estates, but it is within the province of the estate to make the most of the improved strains, and by weeding out undesirable animals and allowing those to reproduce in which desired characters are evident, to maintain a steady improvement. Rabbits, hares and poultry may all be improved by similar means.

It is evident that much remains to be done in the matter of definite control of the breeding of animals for the production of improved kinds, and of obtaining carefully separated strains for definite purposes. The efforts made in this direction should not be confined to the importation of pedigree animals, but a definite and continuous selection of the dams, with certain ends in view, should be made, with the result that individuals will be obtained whose character has an intimate and useful connexion with the purpose for which they are used. In this way, a greater intensive efficiency of both the large and smaller animals may be gained.

RECENT EXPORTS OF HIGH-CLASS INDIAN CATTLE.

BY E. SHEARER.

(From the *Agricultural Journal of India*, Vol, IV., Part IV., October, 1909.

During late years there has been a considerable and increasing exportation of the best of our Indian breeds of cattle to various parts of the world. The agents deputed to select these cattle have paid and are paying very high prices for those selected. The exports have chiefly gone to Africa, North and South America, the Straits Settlements, the West Indies and the Dutch East Indies.

No harm to India is being done as a demand of this sort must encourage the breeding of high-class cattle if it is definitely made known to breeders that the demand is likely to continue.

Professor Wallace, of Edinburgh, who is at present travelling in America, communicates the following information from Chicago:—"I have seen on the Pierce Estate, Texas, a lot of 23 pure bred Indian cattle, nearly all bulls, which at great expense were imported by the Trustee, Mr. A. P. Bordin, fully two years ago. The Gujarat, Hissar, Krishna Valley, Nellore and Gir breeds are all represented. The crossing with the "range" cows of the country has been most successful. The young cattle are a decided improvement in size on the indigenous stock. Ticks do not live on them and flies do not trouble them much. I really think that the Indian cross is the one for the hot Southern States where European cattle do not do well, cannot keep fat and do not breed regularly. This is very much the same problem as I found in Rhodesia last year, and it may probably be solved by obtaining a strong blend of Indian blood."

The justly reputed Gujarat and Nellore breeds which have the advantage of being found near the shipping ports have hitherto been most in demand for export. They are not heavy milkers, but they are unsurpassed in India as draught cattle, and for this purpose and for crossing with the range cattle they are becoming popular abroad. India is not usually regarded as the home of milch breeds, and the tendency has been to import (with the scantiest of success) rather than to export the latter, but from Karachi considerable numbers of Sindi cows, the best of which are good milkers, find their way every year to the Duch East Indies. If India can produce a really good strain of milch cow, there is little doubt that there will be a large demand for it at remunerative prices, in America and Africa and the East and West Indian Islands. In the Montgomery breed, which is closely related to the Sindi breed mentioned above, we have the material from which to develop such a strain. The average yield of milk in the Pusa herd of 39 Montgomery cows last year was over 4,000 lbs. One cow gave 6,300 lbs., another 5,700 lbs. and several over 5,000 lbs. In Mr. Keventer's herd at Simla a Montgomery cow gave just about 7,000 lbs. in her last milking period. The percentage of butter fat in the milk is high, averaging probably 4·5 to 5 per cent. Montgomery cattle are small and shapely, having well developed bodies supported on rather short clean legs. The head is neat, with fairly short horns, and the tail is long and thin, almost sweeping the ground. There is a wide range of colours including red, red and white, black, black and white, white, grey and various spotted colours, but the best cows are perhaps most frequently red or red and white. The cows are exceptionally docile and good-tempered. The young stock mature comparatively early, heifers at Pusa having their first calves at 2½ to 3 years old. The male stock develop into good work cattle. The breed seems to adapt itself very readily to changes of climate, doing well in the arid tracts of its original home in the Montgomery District of the Punjab, in the moist climate of Behar and at altitudes of over 7,000 feet in the Himalayas.

APICULTURE.

BEE-KEEPING IN CEYLON. IV.

BY A. P. GOONATILLEKA.

The native method of bee-keeping in Ceylon depends more on chance or luck than anything else. A start is generally made by fumigating a pot or some such receptaacle with resin or other sweet smelling substance and placing it on a tree, mouth downwards. During the swarming season bee scouts, sent out to find out a place for the swarm to settle in, come across these pots or receptacles and direct the swarm which starts work forthwith. Such a hive, when the bees are once disturbed or their combs taken, is quitted for good. Under this primitive arrangement the manipulation of the bees is difficult, and they are permitted to live in a semi-wild state. In extracting honey from such hives which is done by violent means, one is liable to receive innumerable stings.

With the present method one can force a swarm to settle down in any sort of hive he likes by clipping a wing of the queen. When she is once clipped and unable to fly, all the bees settle down with her and start work. The attachment of the bees towards the queen is extraordinary and their regard for her induces them to stay with her even at the risk of their lives. I have described the difference between the queen, the worker, and the drone. One can easily pick out the queen in a swarm if he only watches patiently for a few minutes. A novice naturally dreads to approach a swarm of bees, but if he is not nervous and handles them gently, he will seldom or never get stung. A nervous person may protect himself with a bee veil and a pair of gloves.

The beginner should not attempt to keep foreign bees, as this would certainly end in failure for the want of experience. Foreign bees are only for the experienced. Italian bees are available in the Island now, but for the present, attention should be directed to *Apis indica*, since it is easily procured, and is less expensive to gain experience with. In Ceylon these bees may be obtained everywhere. If the villagers keep bees, pot hives with bees may be bought from them. The best way to procure bees is, however, to capture them during swarming season, *i.e.*, February and March and July and August. To the beginner this is more troublesome than buying a hive, but the greater trouble of transferring the built combs of a stock is avoided. If bees cannot be purchased, nor swarms captured, then they must be sought for in hollow trees, cavities in rocks, and similar places. Swarms may be discovered by watching for their movements, or getting information as to their whereabouts from villagers.

The beginner should commence with one or two hives only and increase the number as he gains experience. It is better to commence with two, because one can be compared with the other, and anything noticed in one can be checked by reference to the other. Spare combs may be used for foundation. Veils and gloves may be used at first, but they impede free manipulation and should be ultimately discarded. The beginnner should not try to get super honey, nor should he try to raise queens. He should make himself acquainted with the principles of bee-keeping to begin with, and become familiar with the different members of the hive, and various forms of cells, &c. He should try to get some one with experience to show him how to examine a hive, transfer combs, rear queens, clip the wings of a queen, capture a swarm, &c.

If it be asked why bee-keeping has not been carried on as a regular industry in Ceylon, the reply is that it has not been possible because of the barbarous method of collecting honey still in vogue. That this precarious and unproductive system has not been replaced by the modern system is a matter of surprise. But on the other hand modern bee-keeping is comparatively new even in the West, and even now in the rural England, the old show skep is still used. The adoption of modern methods is gradually spreading in Ceylon, but they are bound to eventually take the place of the old.

SCIENTIFIC AGRICULTURE.

SOIL FERTILITY AND SOIL EXHAUSTION.

(From the *Gardeners' Chronicle*, Vol. XLV., 1, 171, June, 1909.)

The theories as to the cause of soil fertility are in general vogue. According to one, which may be called the chemical theory, a soil is fertile which possesses the chemical compounds such as nitrates, phosphates, and salts of potash, necessary for the growth of plants, in sufficient quantity and proper condition of solubility. The second or physical theory, holds that the essential factor in soil fertility is its relation to water. Roots of plants require air as well as water. The root has to supply the leaves with large quantities of water. Only when the physical condition of the soil admits of the root of a plant obtaining adequate supplies of water and also of air, can the plant grow properly. On the physical theory alone such soils are fertile in which these conditions obtain.

These two theories are not necessarily mutually exclusive. We may combine them into a chemico-physical theory, and attribute fertility, in part, to the presence in the soil of the essential mineral substances, and, in part, to the proper relations of soil to water.

The extreme adherents of the physical theory go further than this, and are apt to maintain that a soil does not become exhausted by plants in consequence of the removal by the latter of the available chemical food materials. They urge that as such materials held in solution in the soil-water are taken up by the roots of plants, corresponding quantities of similar substances pass into solution and thus replace in the water of the soil those absorbed by the plant.

On this view it is not easy to understand how the addition of definite chemical fertilisers produce their well-marked effects on soil fertility. If a soil slacks phosphates, for example, it is easy to understand the beneficial result following on the addition of phosphatic fertilisers. But if a soil does not lack phosphates, how can the addition of these substances produce, as in certain soils, and on some crops it indubitably does produce, an improvement in fertility? The workers in the Bureau of Soils of the United States Department of Agriculture propose to explain such facts as these on a new hypothesis of soil fertility and soil exhaustion. According to this hypothesis, soil fertility is not reduced because of the removal by the crop of mineral food materials, but because the crop forms a definite, chemical poison, which is liberated in the soil and acts adversely on the following crop. The rôle of artificial, chemical manures is to neutralise the poisonous effects of the toxic root excretions. The supporters of the toxic theory, as it may be called, have brought forward a considerable body of evidence in support of the suggestion that plants excrete definite poisonous substances, and they urge that the common practice of rotation of crops lends support to their view. It is too early yet to pronounce definitely either for or against the toxic theory, though that it will replace altogether the chemical theory would seem improbable. It is not unlikely that the toxic substances produced in the soil represent not the excretion of plants but the by-products of the activity of certain races of soil bacteria. A vast and almost untilled field of investigation is presented by the bacteria of the soil, and it is probable that soil fertility will be found to depend on chemical, physical and biological factors, not solely on one of these, and to be the consequence of complex, diverse conditions rather than of one condition only.

THE EXPERIMENTAL ERROR IN FIELD TRIALS.

BY A. D. HALL, M.A., F.R.S.

(From the *Journal of the Board of Agriculture*, Vol. XVI., No. 5, August, 1909.)

In all experimental work some error is inevitable; it is only on paper that results come out exactly, but when dealing with things, even the simplest measurement involve an error, the magnitude of which depends on the methods employed. A carpenter measuring a table with a foot-rule can with care be exact to within an eighth of an inch; the maker of fine machinery will only allow himself a margin of about a thousandth of an inch; while it is possible with the utmost refinement to make sure of the length of a small piece of polished metal to within about a millionth of an inch. Granting, then, that it is impossible to eliminate error and that absolute correctness is unattainable, the scientific method is to ascertain how large the error is likely to be and decide whether it is such as will vitiate the conclusions drawn from the experiment.

As a rule, we can do this most readily by repeating the measurement, changing, if possible, the process and the instruments used; a consideration of the differences in the results obtained will then show us what is the most probable result and within what limits it is likely to be correct. If, for example, successive measurements of a piece of land bring out the area as 184,184·3, 183·5, 184·6, and 183·3 square yards, we may accept 184 square yaıds, the mean of the results, as the most probable area, and we may further conclude that we are then not likely to be more than a quarter of a square yard wrong on one side or the other. The more measurements we make the nearer the mean will be to the truth, always provided that there is not some definite source of error which is repeated in all the experiments, such as would be caused by want of trnth in the measuring tape in the example we have been using.

Field trials, whether they are to test the effects of different manures, or different varieties of the same crop, or variations in the cultivation, are generally recognised as being subject to a large number of sources of error, so that it becomes of considerable importance in drawing conclusions from such experiments to know what degree of accuracy in the results we can expect, supposing all the conditions have been favonrable. Of course, after a set of field plots have been laid out, great variations in the soil may reveal themselves, due either to changing subsoil and drainage or to some past irregularity of manuring or cropping. Again, the plots may suffer most irregularly from some insect or fungoid attack. In these cases one must ignore the results entirely and begin afresh. But supposing the field to be sensibly uniform and a good stand to have been obtained, what sort of differences in the yields from two plots may be taken to indicate an effect of the treatment they have received, and what must be regarded as covered by the natural variation due to unknown causes?

We may take the Rothamsted experiments as satisfying all the external conditions of accuracy; the land is reasonably uniform, more care is given to the plots than would be possible under ordinary farming conditions, while the staff have both experience and organisation to ensure accuracy in weighing and measuring the produce. If we then select from the Rothamsted records various pairs of plots receiving the same treatment, we find at once that they do not give similar yields year by year, but vary with considerable irregularity. As an example, we may take the two unmanured plots on the grass field and set down both their actual and relative yields for the last fifty years. If the soil of the two plots is identical, they should show the same result after a certain number of years; but if there is some permanent difference between the two revealed by the averages, it will be possible to see how far this difference would be made evident by a single year's trials.

Looking at the relative yields set ont in Table I., we see that Plot 12 in 37 years out of the 50 gave a bigger crop than Plot 3, bnt on thirteen occasions it gave less: taking the mean of the whole period, its relative yield is 110 against 100 for Plot 3. Granting, however, that it is really about 10 per cent. the better plot, there have been many years when it gave a 30 per cent. better yield, and in one year it was 96 per cent. better; on the other hand, it was on two occasions 10 per cent. below Plot 3. Mathematicians have devised a process whereby we can calculate from such a collection of results the value we may safely attach to the result, and using this method, we shall find that the "probable error" of the mean result is about 2 per cent.; *i.e.*, from the fifty years' results we may conclude that there is an inherent superiority in Table I.

ACTUAL AND RELATIVE YIELD ON TWO UNMANURED GRASS PLOTS, ROTHAMSTED.

	Yield of Hay.		Relative yield of Plot 12. Plot 3 = 100.		Yield of Hay.		Relative yield of Plot 12. Plot 3 = 100.
	Plot 3.	Plot 12.			Plot 3.	Plot 12.	
1856	2,515	2,351	93	1882	2,524	2,340	93
1857	2,856	2,592	91	1883	2,266	2,322	102
1858	2,472	3,360	136	1884	1,804	1,996	111
1859	2,540	2,576	101	1885	2,101	2,339	111
1860	2,760	2,884	104	1886	2,547	2,672	105
1861	2,844	3,304	116	1887	1,471	1,330	90
1862	3,052	3,424	112	1888	2,296	2,298	100
1863	2,284	2,844	125	1889	2,638	2,383	90
1864	2,688	2,808	104	1890	1,648	1,565	95
1865	1,296	1,932	149	1891	2,060	2,422	118
1866	2,660	3,012	113	1892	1,627	2,130	131
1867	3,332	3,048	91	1893	391	487	125
1868	1,960	2,676	137	1894	2,685	2,538	95
1869	4,256	4,352	102	1895	1,402	1,399	100
1870	644	1,260	196	1896	1,144	1,272	111
1871	2,844	2,960	104	1897	1,742	2,048	118
1872	1,644	2,252	137	1898	1,922	2,256	117
1873	1,372	1,804	131	1899	1,342	1,788	133
1874	1,412	1,642	116	1900	1,379	1,859	135
1875	3,620	4,232	117	1901	455	765	168
1876	1,384	1,599	116	1902	1,004	1,200	119
1877	2,360	2,165	92	1903	1,509	1,571	104
1878	1,848	1,832	99	1904	2,949	2,872	97
1879	3,028	3,157	104	1905	1,936	2,297	119
1880	848	1,081	127				
1881	1,480	1,393	94	Av.	2,057	2,254	110

Plot 12 over Plot 3 which is certainly more than 8 but less than 12 per cent. The mean error of a single year's result is, similarly 10 per cent.

Table II.

Plot	1904. Swedes.	1905. Barley.	1906. Mangolds	1907. Wheat.	1908. Swedes.	Mean of 5 years.
A...	98·1	88·8	95·8	86·3	92·8	92·3
B...	95·8	92·4	90·6	95·1	94·9	93·7
C...	101·0	98·9	99·2	102·4	100·2	100·3
D...	101·7	114·1	105·0	109·1	114·9	109·0
E...	103·4	105·8	109·2	107·0	97·3	104·5

Taking another example, Table II. gives the results obtained in the last five years on five plots in Little Hoos Field which have received exactly the same treatment; in order to make it easier to judge the figures, the actual yields each year have been reduced to a common standard, taking the mean of all the five plots as 100.

The experiment had to be started on the assumption that all the plots were exactly alike, and if so, the mean error attaching to the result of a single plot in any year is 7·5 per cent., but with the five years' trials it is beginning to be clear that there are some real permanent differences between the plots, which improve from A. to E. Still, whatever may be the real position of each plot as revealed after further years of experiment, we may expect in any one year to find a particular plot 7·5 per cent. in error on one side or the other.

Space does not permit of the consideration of more cases, but the general result of the examination of many series of experiments indicates that the mean error attached to the yield of a single plot is about 10 per cent. plus or minus. In other words, if we have three experimental plots giving yields of 91, 100, and 110 respectively in any one year—for example, 18, 20, and 22 tons of roots—it is not right to conclude that such differences have been brought about by the treatment; the three plots must be considered as giving equal results. Of course this figure is obtained from a consideration of the Rothamsted results only, and other soils might be found on which the conditions were so much more uniform that the experimental error will be reduced and a closer agreement between duplicates would prevail. The examination I have made of other data, however, though they do not permit of working out the mean error over such long periods, yet lead me to suppose that a 10 per cent. error is near the truth generally, and may be taken as a safe guide for working purposes. In the records of experiments a good deal of strained arguments is often spent in explaining results or drawing conclusions from them when the differences are much less than the 10 per cent. which we have thus found to be the average error attaching to a result obtained under favourable conditions. Much of this might have been spared if the experimenter had kept clearly before him the fact that nothing less than 20 per cent. differences have much significance in a single experiment. The only way of reducing the experimental error and obtaining a closer result is to multiply the experiments, either by repeating them year after year or by increasing the number of plots, preferably both, because there may be constant differences in the soil, while the season also may induce variations in the effect of the treatment. The first step, however, is to multiply the number of plots set aside for each kind of treatment; taking five plots irregularly distributed about the field, we shall obtain in a single year a result that is as accurate as need be, except for special variations induced by the character of the season. Of course this means a considerable increase in the amount of work attached to the experiment. For example, instead of six plots each of half an acre, we ought to take thirty plots of a tenth of an acre, six different kinds of plots and five of each kind; every plot would also need to be harvested and recorded separately. Such a form of experiment is necessary if small differences are to be brought out, as, for example, the differences that exist between the various kinds of barley usually grown in this country.

Increased accuracy is not to be obtained by increasing the size of the plots; it is questionable whether irregularities of soil are likely to be more or less pronounced on large plots, and with very large plots one new source of error is always introduced—the difficulty of getting the cultivations, sowing, harvesting, &c., of all the plots carried through in the same day. As long as the plots are above 1-40 acre size does not matter much, and the size that is most convenient for the handling of the crop, its weighing, storage, threshing, &c., should be selected, always remembering that it is by the number of plots only that the error can be reduced.

It is altogether wrong to take large plots and then select small areas within the plot for weighing. Such a proceed-

ing introduces the most fatal error of all, a selection biased by the preconceived opinion of the experimenter. It is also incorrect to make allowances for missed plants, as is sometimes done by counting the number of roots and calculating what the weight per acre would have been had there been a perfect plant. Most manures affect the texture of the soil, and therefore the number of plants which establish themselves is one of the factors in the result that is directly affected by the manure.

One or two other practical points are also raised by the recognition of an average error of 10 per cent. in the results of a single plot. In designing field experiments, it is useless to include small differences in treatment which are not likely to induce more than 10 per cent. differences in the yield, unless the experiment is going to be repeated very widely or carried on for several years. For example, in dealing with hay it would be of little use to set out conclusions from comparative plots, one with one cwt. and the other 1½ cwt. per acre of nitrate of soda, or in an experiment on roots, one plot with 4 cwt. of superphosphate per acre as against another with 6 cwt.; in each case the differences due to the manuring are likely to be smallar than the experimental error. Finally, in view of a 10 per cent. experimental error, it is no good pretending to an accuracy in recording the results.

For example, we have read the following figures :—

	Weight of roots per acre. Tons.	Cwt.	lb.
Swedes, Champion ...	11	9	28
,, Crimson King ...	14	16	48

Now, putting aside the barbarous units of tons, cwt., lb., so cumbrous to write and difficult to read, what possible value can be attached to the figures representing cwt. and lb. As only the produce from 1-40 acre was actually weighed and then multiplied up to obtain the figures quoted, the inclusion of a few clods of earth more or less with the roots, or an error of a few inches in the measurement of the plot so as to include one root extra would make a difference in the cwts. moreover as duplicate plots would be likely to differ in the tons, very little attention need be given to the cwts. Had the results been written 11·5 and 14·8 tons respectively, the figures would still be a degree more accurate than the reality. Of course, the experimenter must record what he actually obtains to the nearest pound or ounce if his scales tell it to him, but to set out such figures in the published report is to make a parade of accuracy which cannot be sustained.

Returning, however, to our original point of view, we may conclude that as absolute correctness in our results is impossible, it is only by recognising and measuring the extent of the inevitable error that we can reach a due measure of accuracy in the conclusions we draw from them.

INOCULATION OF LEGUMINOUS CROPS IN THE WEST INDIES.

(From the *Agricultural News*, Vol. VIII., No. 184, May 15, 1909.)

During the year 1908, the effect of inoculating the soil, or in some cases the seed to be sown, with prepared cultures of nitrogen-gathering bacteria was tried at Antigua and Grenada, with the object of ascertaining whether such a procedure would stimulate the growth and increase the crop returns of various leguminous crops. At Antigua, where cowpeas, woolly pyrol, and alfalfa were the crops under experiment at the instance of Messrs. Henckell, Du Buisson & Co., Professor W. B. Bottomley's 'Nitro-Bacterine' was the inoculating material used, but at Grenada, a culture preparation sent out from the United States Department of Agriculture was employed. It may be added that experiments in which a small number of sugar-cane plants were inoculated with a special culture prepared by Professor Bottomley, in the hope that it might be beneficial in increasing the yield, were also carried out at Antigua and Barbados.

At Antigua inoculation experiments were conducted at the Experiment Station, and also at Fitches' Creek, Gambles, and Cassada Garden.

Seed of the different crops sown was inoculated at the Laboratory, and part of the culture solution was used in inoculating the soil, and later on the growing crops. Where crop and soil inoculation was carried on, two applications of the solution were made, at an interval of a fortnight.

No effect of inoculation could be traced in the case of the cowpeas grown. Practically no differences were observable between the treated and the untreated plots. It is therefore to be presumed that the soils in the experiment plots were well stocked with the bacteria responsible for nodule formation on this crop, or that they were well supplied with available nitrogen.

With woolly pyrol the results of inoculation were, in the case of one estate, more definite and satisfactory. The experiment plots were each ⅛-acre in area, and from the plot sown with seed that had not been inoculated 330 lb. of green bush was gathered. A second plot also sown with uninoculated seed, but which was 'watered' with the culture fluid, yielded 700 lb. of green bush; a third plot that had been sown with inoculated seed gave 970 lb. of bush, while from the fourth plot, sown with inoculated seed, 1,015 lb. of bush was reaped. It will be seen that in the cases indicated, inoculation seems to have been distinctly beneficial for woolly pyrol. At two of the stations, however, all the plants on the experiment plots were destroyed by caterpillars. No report has yet been received on the trials with alfalfa.

The Grenada experiments were designed to ascertain (1) whether any benefit is to be derived from inoculation of leguminous crops on Grenada soils, and (2) whether, by inoculation, leguminous green dressings, such as cowpeas, can be grown under the shade produced by full-grown cacao. The trials were made at the Experiment Station, and on six different estates in the island, where the crop under treatment was cowpeas, which were inoculated with a material prepared especially for this plant.

At the Botanic Station and two of the estates, the results obtained showed no difference whatever in favour of inoculation. At two other estates, the returns from the inoculated plots were slightly superior to those which had not been treated. Finally, on the two remaining estates—Dougaldston and Diamond—it is reported that the inoculated plots gave yields very considerably higher than the untreated plots, although no actual figures are stated.

Inoculation, however, had no effect in influencing the growth of cowpeas planted beneath the shade of cacao trees, and these failed completely in all cases. The results of the experiments, therefore, give a negative reply to the second question suggested above.

It may be added that the inoculation of sugar-cane plants with Professor Bottomley's culture preparation could not be observed to have any effect whatever, either at Antigua or Barbados.

MISCELLANEOUS.

LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE.

BY J. C. WILLIS.

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AGRICULTURAL BANKS.

BY T. B. POHATH-KEHELPANNALA.

The proposal to establish Agricultural Banks should be heartily welcomed by all who are interested in agriculture. Though the suggestion is said to be due primarily to the stagnation in paddy cultivation, it would be impossible to limit the operation of the banks to the encouragement of rice-growing only, especially as improved methods of cultivation include the rotation of crops.

DISADVANTAGES TO AGRICULTURE.

The falling off in paddy-cultivation in spite of the high rates that have for some years ruled for imported rice, is due to various causes. Many leading Kandyan families have sold their ancestral holdings to Europeans and others, often below the real value, owing to their want of funds to cultivate them. It frequently happens that the lands are situated in distant parts, difficult of access, and the owners have considered it more profitable to sell them, in some cases, to devote the proceeds to the purchase of lands nearer home, or to pay off debts, or to defray the costs of some tedious and ill-advised litigation. The poorer members of the community think it hardly worth while to cultivate them with garden products, considering the difficulties occasioned by long distances, of continuous watching to prevent trespass and theft, and many have taken up work on tea and cacao estates for daily wages.

Others who could afford to cultivate them neglected to do so; the spread of education has resulted in a general yearning for work in Government offices. One

DISASTROUS RESULT

in the sale of chena is manifest by the obstruction to paddy cultivation by the washings of silt and debris to the irrigation channels and fields. Litigation on this point between planters and natives are not uncommon in our law courts. Added to this, the

SALE

of chena by the Crown is, in many cases, responsible for the neglect of paddy cultivation. In former days every field had its appurtenant chena lands to provide pasturage for cattle, reepers, and timber for agricultural implements. The purchasers of these lands have planted them up to the very

THRESHOLDS

of the villagers; the paddy cultivator has no longer any space for breeding or even feeding cattle, the supply of firewood is almost improcurable, and the slightest act of trespass by his cattle on the adjoining estates involves a heavy fine on the unfortunate owner of the cattle.

The villager has never been in the habit of tethering his cattle, but he allows them to roam about at will, to return home at dusk. Among the many subjects connected with paddy cultivation, the establishment of village grazing grounds and the introduction of new and useful fodder plants would

afford welcome relief in every village, where pasturage is at present a scarcity.

The neglect of paddy cultivation is due, in some parts, to the abnormably

IRREGULAR RAINFALL

in recent years; but in nearly every district there are fields which might be relied on to give regular crops, if small storage tanks were constructed at the head of each range of fields. Many fields are only occasionally cultivated, only at intervals, for the reason that they are wholly dependent for cultivation on rain-water. The cost and maintenance of these would be little, and the whole expense of bringing a few acres into permanent cultivation would be reaped in a single season. Other fields which are irrigated by *amunu* (water courses), where there is an inexhaustible water-supply, yield regular crops, and could be cultivated both for *yala* and *maha* seasons.

It is generally believed that the

INDEBTEDNESS

of the paddy-grower is due to the exorbitant rate of interest paid for seed paddy. It may be that this is so in some cases, but it is not so in all cases. The customary rate of interest charged is 8 lahas for every 10 lahas seed-paddy, viz., 5 lahas as interest, and 3 lahas in addition for wastage called *bollehi* or "*diyabesma*." In lending out paddy for ordinary purposes, for one pela or 10 lahas, only 5 lahas paddy is charged by the lender, by way of interest, whether the borrowed paddy is returned within a year or both after the lapse of 4 or 5 years. The period of time during which the loan is outstanding makes no difference. The interest is always the same and does not increase by increase of time.

I should say that the Kandyans are a very

LITIGIOUS

people, they often contract heavy debts for law-suits. Unlike the low-country Sinhalese, the Kandyans are not extravagant in dress, food, building houses or marriage festivals.

But it is obvious that, when an Andé-cultivator is obliged to borrow seed paddy he must also

INCUR DEBTS

to provide for the hire of buffaloes and men, and for other items connected with cultivation; he will also in many cases be prompted to borrow sufficient paddy to provide food for himself and his family until his crop is harvested. The poorest Kandyan villager, who possesses nothing beyond his hereditary love of paddy cultivation, often takes up the work of a field on the *karu andè* system (for a ¼th share), jointly with the owner. Even if the crop is a good one, he will, after paying off his liabilities, have very little return for his labour.

The smaller paddy-fields are usually cultivated by the owners themselves, but owners of large fields lease parts of them on the half-share (*andè*) system. When paddy-fields are let out in this way, the owner takes no share in the labour, nor does he bear any part of the expenses, so that practically he receives as rent *half the crop plus the value of the expenses of cultivation.* Here the *andè*-cultivator runs into debt to carry on the different operations in the field.

It has been found that the

MOORMAN

is the *greatest pest* to the Kandyan villager. He haunts about the whole village, and buys everything he could lay his hands on, at the cheapest rate possible, and sells his purchases to the nearest town at great profit to himself. What is worse, he lends out money and paddy at exorbitant rate of interest, the poor ignorant villager is easily victimised, with the result that he is obliged in the end to transfer his ancestral property to the rapacious Moorish usurer.

The operations of the Agricultural Banks in advancing seed paddy and cash to cultivators may be greatly helped forward if

INSTRUCTION

in improved methods of cultivation is made freely available. The effect of occasional demonstrations of ploughing with new styles of ploughs, &c., is limited. It ought to be possible to arrange for the systematic cultivation of paddy-fields in convenient centres, where, every operation—from the sowing of nursery plots and transplanting the seedlings to the harvesting of the grain—may be studied.

As regards the issue of seed paddy and cash advances, it would perhaps be advisable to stipulate that the loans be made only on the condition that the cultivator adopts all the new methods suggested for the improvement of agriculture.

The Committee will doubtless insist on local branches being formed, composed only of those who are especially qualified as land-owners and those who take a real interest in agriculture. Many of the Minor Headmen can hardly be classed as such.

Pohath Walauwa, Gampola,
19th November, 1909.

MINUTES OF A MEETING OF THE COMMITTEE OF AGRICULTURAL EXPERIMENTS:

HELD AT THE EXPERIMENTAL STATION, PERADENIYA, ON 11TH NOVEMBER, 1909.

The following members were present:—Mr. R. H. Lock (Chairman), the Entomologist, the Mycologist, the Agricultural Chemist, the Secretary (C. J. C. Mee), the Hon'ble the Government Agent, Kandy, the Hon'ble Mr. Edgar Turner, Messrs. Rosling, Jowitt, Anderson, Davies and Vanderstraaten,

Mr. Bamber read the Progress Report on the Experiment Station since the previous meeting, and the following resolutions were passed:—

1. That quarterly measurements of rubber trees, referred to in Mr. Bamber's report, be taken, and that Plot 87 be forked every three months very deeply. For the first time 9″ and later forkings 6″.

2. That an estimate of expenditure for 1910 be drawn up, showing the distribution over the various items. This was placed in the hands of sub-Committee consisting of Mr. Jowitt, Mr. Bamber, and the Superintendent.

Mr. Vanderstraaten suggested that coconut trees be scientifically investigated as regards planting distances, habit of flowering and maturing nuts, and the time occupied during the various stages.

Rosolved, that a scheme be drawn up for the future, and the plan definitely followed out during a period extending over several years, and that Messrs. Bamber and Vanderstraaten submit it at the next meeting in January, 1910.

CHAS. J. C. MEE,

Secretary and Superintendent, Experiment Station, Peradeniya.

16th November, 1909.

PROGRESS REPORT ON EXPERIMENT STATION, SINCE PREVIOUS MEETING HELD ON 9TH SEPTEMBER, 1909.

TEA.—Plots 141-143 and 151-155 have been tipped.

Polts 146-150 of Manipuri indigenous have been pruned.

Plot 142 had Indigofera cut at 8″ in September yielding 1,625 lb. It has again formed a good cover.

Plot 148 was sown with Crotalaria just before pruning at 8 lbs. per acre, broadcast up alternate lines.

The plots of Single Indigenous were supplied again with plants from Coolbawn Estate, poor Jat plants being removed.

Plots 151-154 have been re-supplied with Udapolla Para stumps.

CACAO.—The 5 acres of Forastero from No. 2 tree have been fully supplied, and the Dadaps cut on the various half-acre plots as required for high and low shade &c.

The plot of Crotalaria and Indigofera half-acre was pruned at 3′ and gave 5,204 lbs. of material which was mulched. More space was cleared round the cacao plants, which were fully supplied.

The steep banks were all sown with Crotalaria and Indigofera. The growth is good and the heavy wash almost entirely prevented.

The Indigofera recovers more rapidly and completely than Crotalaria, and is gradually killing out the latter.

CACAO—OLD.—All the plots were sprayed with Bordeaux mixture. All plots have had Canker removed. It was and is most prevalent in the riverside plots, 8, 9, and 10 and 94-95 by the paddy-fields.

Plot 8 receives 5 cwt. Kainit. Plot 9 5 cwt. Bone Dust. Plot 10 Control. Plot 94A had Potassium Chloride. Plot 94B Potassium Sulphate. 94A Sodium Nitrate. 95B Groundnut Cake. 96A Concentrated Superphosphate. 96B Precipitated Phosphate. Apparently none of these manures have any preventive effect.

A new census of the trees on the plot is being taken, so that the yields can be reduced to a standard.

Manufacture.—The fermenting process was changed according to the suggestions of the Committee at the last meeting, and samples are submitted for inspection.

Experimental fermentation for the production of Alcohol from fermenting beans was tried, and the distillate sent to Colombo for analysis. It was found to contain much ethyl acetate as well as alcohol, and further experiments are being made to regulate the acetic fermentation going on simultaneously.

COCONUTS.—The 10-acre coconut plot has been supplied with the seed from Mr. Nicholas, of which only 9·6 % failed to germinate.

A further 100 germinated coconuts were obtained from Mr. G. T. Nicholas, Goluwapokuna Estate, Negombo, of which 92 were supplied, completing the 10-acre plot.

A further 100 seed have been put to germinate for future supplies if necessary.

Twelve varieties of coconuts are being obtained from Mr. L. W. A. de Soysa, who has kindly offered them free of cost.

Three of the largest kind of coconuts from the Penang Show have been put to germinate.

An experiment with Copra manufacture was tried, the following being the figures obtained. The nuts were generally small :—

10,000 nuts weighed	... 1284·5 lb.		
and contained water	... 163·5	,, =	12·72 %
	1121·0	,,	
The shells weighed	... 376·5	,, =	28·61 %
Kernels	753·5	,, =	58·66 %
Weight of dry Copra	... 337·5	,,	100·00 %
Loss of moisture	... 31·23 %		
Prop. of dry Copra	.. 48·77 %		

The oil Chekku mill has been completed and experiments on oil extraction will be made.

It is proposed to experiment on the effect of sun and heat drying, as the former is said to be better for copra manufacture.

Coconuts from 15 separate plots have been collected and counted prior to manuring experiments being commenced.

RUBBER.—Tapping experiments on the *Manihot dichotoma* were commenced on the 8th October when exactly two years old from planting by two methods.

1st, by cutting a shallow channel and pricking.

2nd, by cutting out the bark to the wood.

The rubber from each tree was weighed and the yields point to great variation in individual trees.

Ceara tapping experiments were also commenced on the same lines on trees six years old and show the same differences. The yield from the *Manihot dichotoma* was generally poor, and the cost of collection, if the yield continued the same throughout the year, would be about 2/30 per lb.

Castilloa tapping experiments have been resumed.

Half-acre plot planted 8′ × 8′ has been fully supplied, 165 cuttings being required. Dry weather occurred after the previous planting which accounted for most of the deaths.

Germination experiments of seed from ten months old and two-year old plants are being tried.

Seed received for testing showed a germination of 85 %.

1,000 seeds of *Manihot heptaphylla* have been obtained and a nursery formed.

The Para rubber trees planted in 1905 have been again measured and show the following increase for ten months :—

	Average.	Row 3.	Row 2.	Row 1.	average increase.
Plot 78					
Soluble manure :					
Dec. 1908...	10·27″	10·71″	10·52″	9·60″	
Oct 1909...		14·78″	14·97″	13·63″	4·18″
Plot 79					
Crotalaria Striata :					
Dec. 1908...	9·96″	10·41″	9·83″	9·63″	
Oct. 1909...		14·16″	13·72″	13·39″	3·80″
Plot 80					
Lemon Grass :					
Dec. 1908...	7·97″	7·71″	8·12″	8·03″	
Oct. 1909...		11·29″	11·20″	10·83″	3·15″
Plot 81					
Indiagofera :					
Dec. 1908...	9·27″	9 34″	9·41″	9·04″	
Oct. 1909...		12·99″	12·98″	14·17″	4·12″
Plot 82					
Blank :					
Dec. 1908...	9·58″	10·41″	9·0″	9·31″	
Oct. 1909...		12·78″	13·76″	13·28″	3·70′

Plot 80. The Lemon Grass was cut in October and mulched.

Plot 81. The Indigofera has recovered after cutting, while the Crotalaria on Plot 79 all died, being too old and the shade too dense.

Plot 82. Crotalaria was resown in curves below each tree 6' from the stem, much of the first sowing having failed from the drought.

FUNTUMIA.—This plot was attacked with the usual caterpillar *Caprinia conchylalis* in September, and spraying experiments with lead arsenate were at once done, but with only partial success

PADDY.—The transplanting of the paddy on half the area has been completed, the lower half being manured as in the broadcast portion.

The effect of the manure was most apparent in the colour of the plants.

Where leguminous plants only had been grown before the paddy the effect was still more marked in the luxuriant colour and sturdy growth.

OIL GRASSES.—A distillation of Maha Pengiri from Java has been made, and the plot utilised for planting out a larger area near the curing house.

The ground has also been prepared for planting out other varieties, which will now be done.

The modified still is being erected and will be completed this week when further experimental distillations will be made with the various pure oil grasses.

CATCH CROPS.—The sun-flower plots have grown well and are now flowering and seeding. The germination of the Mammoth Russian seed was very good. Of the Giant Russian only 50 % germinated.

It is proposed to sow two more plots of Sun-flower now to ripen in dry weather.

Gingelly plots sown on the 25th August seeded but are not yet ready for harvest.

A leaf disease appears to be attacking parts of the plots. Specimens have been sent to Mr. Petch.

Several other plots will be commenced at once in the 10 acres of coconuts now that the N.E. rains may be expected.

FRUIT PLOTS.—The land cleared for plantains is still unsupplied, but the plants are expected to-day, four varieties being promised by the Ratemahatmaya, Beligal Korale, viz., Kolikuttu, Suwandel, Embul and Alukehel.

SOIL WASH PLOTS.—Further plots have been made below the former ones, and all borders grassed and catchment drains deepened and levelled.

The weight of soil from the Desmodium plot given at the last meeting was erroneously entered, as it was from a fall of earth from the path side of the drain and not from the plot itself.

One plot planted with dadap stumps shows a loss of over 61 tons of soil per acre since April, containing at least 207 lbs. of nitrogen, 110 lbs. of phosphoric acid, and 138 lbs. of potash. The cost of supplying this as manure would be nearly Rs. 200 per acre.

GRASS.—Much labour has been utilised to weed supply and manure these plots with cattle bulk.

A roof has been erected over the manure along the whole length of the cattle shed.

NURSERIES.—A new plot by the cattle shed has been cleaned and fenced, and beds of Coffea robusta from Java, coffee from selected trees on the Experiment Station, Liberian coffee, Manihot heptaphylla, &c., have been planted.

COOLIES.—A transfer of money from certain other votes was made on the 25th September amounting to Rs. 500 per month for extra coolies. Owing to the paddy planting season, no Sinhalese were then obtainable but more are now working on the estate, and it is hoped to have a full number until December 31st.

The outturn to date is about 1·25, but from this week an additional fifty coolies are working.

CEYLON AGRICULTURAL SOCIETY.

MINUTES OF MEETING HELD ON DECEMBER 18TH, 1909.

Minutes of the 49th meeting of the Board of Agriculture, held at the Council Chamber on Saturday, the 18th December, 1909, at 12 noon,

His Excellency the Governor presided. There were also present:—Sir Hugh Clifford, K.C.M.G., the Mr. H. L. Crawford, G.M.G., Hon. Messrs. W. H. Jackson, P. Arunachalam, F. C. Loos, C.M.G., S. C. Obeyesekere, Dr. H. M. Fernando, M.D., Messrs. J. Harward, R. H. Lock, R. W. Smith, W. A. de Silva, Tudor Rajapakse (Gate Mudaliyar), L. W. A. de Soysa, J. D. Vanderstraaten, S. D. Dabere, James Pieris, J. P. Jayawardene (as a visitor), and the Secretary.

Minutes of the meeting held on October 8th were read and confirmed.

Progress Report No. 47 was adopted.

Statements of Expenditure for October and November, 1909, were tabled.

The consideration of the Report of the Model and Experimental Gardens Committee was, on the suggestion of His Excellency the President, postponed for the next meeting, when it is expected that the Hon'ble Mr. Kanagasabai will be able to be present.

The final Report of the Tobacco Sub-Committee was presented by Mr. R. H. Lock and adopted on the motion of Dr. Fernando, seconded by the Hon'ble Mr. Loos.

The Secretary read a "Memorandum on his Recent Visit to India."

At the close of the meeting, His Excellency presented Mr. Philip Denzil Jayawardene a gold medal awarded by the Society to his father, Mr. G. W. Jayawardenya (deceased) at the last Anuradhapura Show for a collection of new products and for pioneer agricultural work in Tamanakaduwa district.

C. DRIEBERG,
Secretary, C. A. S.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT XLVII.

Membership.

Since the meeting of October 18, the following members have joined the Society:—T. E. Wanger; B. J. Santiago; L. S. Woolf; B. Wolde; the Superintendent of Police, Central Province; the District Inspector of Police, Hatton; the Sub-Inspector of Police, Nuwara Eliya; A. C. Chamberlin; the Manager,

Jendarata Rubber Co., Ltd.; S. Dias Krisnaratne; C. J. Hutchinson; Ronald Wells. This makes a total membership, up to date, of 899.

A new Branch Society has just been established at Ransègoda, in Matara district, with a membership of 108. The Honorary Secretary, in applying for affiliation with the Parent Society, reports that experiments on an extensive scale are undertaken by individual members.

Official Tours.

The Secretary visited the Northern Province, the Dumbara and Hambantota Districts, Mirigama, and Kitulgala.

Mr. Wickremaratna, Agricultural Instructor, was engaged for some time at Tissa, co-operating with Mr. L. A. D. Silva in supervising the ploughing operations; visited Chilaw to lay out the Chena Experimental Garden; and has since been engaged in giving a series of demonstrations in ploughing in Uva.

Mr. Molegode, Agricultural Instructor, after completing his tour in Matale East, took up the Southern division. He was summoned to Colombo to assist in the distribution of the large consignment of grafted plants imported from India, after completing which he visited the Chilaw district, and returned to his station. He has since visited Leliambe, Kuruwila, Tenne, Owiiikande, Palapatwela, Teldeniya, Udispattu, Alawatugoda, Idamagama, Ankumbura, Talatu-oya, &c.

Mr. L. A. D. Silva, Agricultural Instructor, was specially deputed to supervise the ploughing operations in the Hambantota District, and is at present incapacitated from active duty by a severe attack of malaria contracted at Tissa.

Mr. Breckenridge, Agricultural Instructor, visited Kalmunai, Akkaraipattu, Mahilur, Mandur, Samanturai, Kulavady, Tambelivil, Sampuveli, &c., in connection with ploughing trials and experiments in cotton cultivation.

Mr. Chelliah, Agricultural Instructor, did some good work in demonstrating the use of light iron ploughs in the Eastern Province, at the request of the Government Agent; since his return to his Province he visited Vavuniya, and subsequently held a ploughing demonstration at Anuradhapura.

Branch Societies.

The *Dumbara* Branch held a Special General Meeting at Teldeniya on October 16, when Mr. Dunuwila, Disava, presided, and the Secretary of the Ceylon Agricultural Society was present as a visitor. Mr. Rambukwella, Korala, read a report on his experiment in the cultivation of paddy with artificial manures. It was resolved that the report be printed and circulated for general information, the Secretary, Ceylon Agricultural Society, undertaking to get the necessary number of copies printed. The Honorary Secretary gave notice that he was ready to receive applications for manure recommended for paddy by Messrs. Freudenberg & Co.

It was resolved to hold an Agricultural Show at Teldeniya in July next, and a Committee of Management was appointed. At the termination of the business on the agenda, the Secretary, Ceylon Agricultural Society, addressed the meeting on various matters connected with the work of the Society. Following upon the General Meeting, a meeting of the Co-operative Credit Society was held. Five members repaid loans to the amount of Rs. 282, and Rs. 40 were received for deposit.

The *Harispattu* Branch held a meeting of committee on October 17, when the question of a model and experimental garden again came up, and the Koralas of Kalugammana and Medasiya pattu were deputed to select a suitable site. It was decided to hold a Show in 1910. The President consented to distribute the prizes awarded by Mr. Molegode to the boys possessing the best knowledge of gardening at the competitive examination held recently; when 19 boys from Nugawela, Alawatugoda, and Idamagama schools entered, and the successful candidate was G. W. Mutu Banda of the last-named school; B. Appuhamy of Nugawela Boys' Vernacular School, and L. B. Ratnayake of Idamagama coming second and third respectively.

Experimental and other Gardens.

The question of the Society giving systematic aid to model and experimental gardens established in the Provinces came up in the form of a motion brought up by the Hon. Mr. A. Kanagasabai at the meeting of the Agricultural Board held on October 18, when a committee, consisting of the Hon. Messrs. Bernard Senior and Kanagasabai, Sir Solomon Dias Bandaranaike, Messrs. W. D. Gibbon, R. H. Lock, W. A. de Silva, Dr. H. M. Fernando, and Mr. C. Drieberg was appointed to report on the proposal. This committee met on October 30 and November 25, and its report is submitted at this meeting.

Existing gardens will probably have to be brought under the general scheme from next year.

Implements and Appliances.

The Secretary's visit to the *Hambantota* District was chiefly in connection with the ploughing operations carried on there. It was reported that some difficulty was being experienced in the setting of the "Meston," and that the arm of the "Climax" required strengthening, and these matters received attention. The American "Pony" plough is proving to be the most satisfactory of the three, and when the cultivators have become reconciled to its novel appearance and weight, and see the economical work it does, they will probably not mind the extra cost. The more intelligent, who can afford to pay its value, are adopting this implement.

Mr. Valoopilley, writing on October 15 from *Anuradhapura*, reports: "The Pony plough and the Cultivator do good work. They are not at all too heavy for a good ordinary pair of bulls. I have decided to cultivate about 25 acres this year with the aid of these implements. I beg to thank the Society and its Agricultural Instructor, Mr. Chelliah, for their assistance."

The Government Agent, *Eastern Province*, writing on October 4, forwards a letter from Mr. J. W. Cotton, of "Easter Seaton," Batticaloa, who states: "The Pony plough is the best of the three."

The following letter, received as this report was being drawn up, furnishes pleasing testimony of the good work done by the Society in rescuing the cultivators of the Hambantota District from financial loss and possible want:—

"SIR,—In continuation of my letter No. 3,865 of the 4th instant, I have the honour to inform you that the results of the work done by the Society's officers are most gratifying.

"2. A large acreage of land has been ploughed, and I do not anticipate that at the end of the cultivation much less land will be sown than in previous years. What this means may be understood from the fact that between 4,000 to 5,000 acres are normally cultivated, and that the buffaloes now in Tissa are scarcely sufficient to mud 500 acres. The result is largely due to the assistance given by your Instructors.

"I am, &c.,

"L. S. WOOLF.

"Assistant Government Agent."

Paddy.

Mr. N. A. S. Jayasuriya, whose experiment in the cultivation of paddy by transplantation was referred to in the last Progress Report, has furnished the following details:—"The extent cultivated was one acre, the quantity transplanted eight seers, the yield 79 bushels, of which, however, 49 bushels represented good seed, $7\frac{1}{2}$ broken in threshing, and the balance empty grains. The only additional expense was on account of transplanting (Rs. 4·50) and manure (Rs. 2·50). The highest yield of my broadcast fields for the same period was 20 bushels per acre, and for these 2 bushels of seed per acre were used. Taking the yield in the transplanted bed to be, in round numbers, 50 bushels, we get with $\frac{1}{4}$ bushel (8 seers) of seed a yield equal to 200-fold, while with broadcasting the yield is only equal to 10-fold. The distance observed in planting out was 9 inches each way."

The teacher of Talatu-oya Boys' Vernacular School is conducting an experiment in paddy cultivation by transplanting, under the instruction of Mr. Molegode, Agricultural Instructor, who reports that the teachers and boys are taking great interest in the experiment.

A small quantity of *Samudrabali* paddy was received from Chinsurah for Mr. C. M. Sinnayah, Mudaliyar of Jaffna, and seven varieties of *Samba* were procured for Mr. K. Canagasabey of Batticaloa, through the kindness of the Deputy Director of Agriculture, Southern Division, Trichinopoly.

Cotton.

The Sea Island seed received from Liverpool was distributed among applicants, chiefly in the Northern and Eastern Provinces and the Hambantota District; some of it also going to the Maldive Islands. The seed, on being tested, was found to be in excellent condition.

Re Tea-*cum* Cotton planting, Mr. M. Kelway Bamber reports: "I should certainly not recommend cotton as a catch-crop for tea, unless the soil and climate are particularly favourable. It would also certainly check the growth of the tea, and might be the means of introducing some pest into the fields. A separate experiment might be tried, if it is thought there is sufficient labour to harvest the cotton when ripe. If the estate is liable to wind, much of the cotton would be lost."

Seed and Plant Supply.

The distribution of the regular consignment of *vegetable seeds* for north-east monsoon planting has been completed. The *grafted fruit plants* that were

expected in October (all except Sapodilla, which ran short) have also been distributed.

Cluster Sweet Potatoes yielded a most satisfactory first crop within five months. There has been a brisk demand for cuttings, and the new introduction has already spread far and wide. *Lima beans* received from America and India were sent to suitable localities.

A variety of other plants, such as cacao, Johore jak, custard apple, pomegranate, rambutan, orange and mandarin, bamboo and shade trees, has been sent out to applicants.

The publication of Mr. Macmillan's illustrated article on the *tree tomato* in the Magazine of the Ceylon Agricultural Society has brought a number of applications for seeds of this fruit.

The Secretary received from Mr. George Schrader of "Wester Seaton," Negombo, a magnificent sample of *Chinese ginger* raised from "seed" supplied from the Government Stock Garden. Mr. Schrader, in forwarding the sample, writes that he got as many pounds as he planted ounces. The Secretary is shortly expecting a hundredweight of seed-ginger from Cochin.

Applications for seeds and plants are being constantly received from non-members who are coming to look upon the Society as a universal provider for agricultural and horticultural purposes. Such applicants should realize that it is not the object of the Society to make free gifts to all and sundry, but that the privileges offered by the Society are available only to members who pay a small annual subscription for which they get a great deal more than the value of their money in return.

Analyses and Reports.

On a proposal to cultivate sugar-cane on an extensive scale in Matale North, the Government Agricultural Chemist reports: "Unless irrigation is possible, sugar-cane is hardly likely to grow profitably in the Matale District. It is a plant that requires a fairly rich soil, and even under the best conditions in Java, with every facility for transport, &c., is hardly paying. A small area to supply sugar-canes to Kandy might pay, but on a large scale it would, in my opinion, be a very risky experiment."

The two chief regions where cane is cultivated are the low lands of the Colombo District, which supply the town with sticks for chewing purposes; and the Baddegama district, where it is cultivated on a fairly extensive scale for sugar manufacture, which still pays as a native industry, particularly when the produce is disposed of as unrefined sugar and treacle, for which there is a ready demand.

Mr. Bamber has kindly favoured the Society with the following report on the question of how best to eradicate grass on gravel paths:—I have made several experiments to destroy grass and other weeds on roads and paths. Arsenite of soda applied at frequent intervals destroys them temporarily, but grasses with stoloniferous roots keep on growing until the whole reserve starch in the roots is destroyed. This can only be done by spraying as soon as new blades are a few inches high, and before new root development has taken place. Experiments are now being made with a strong solution of sulphate of iron as recommended for killing charlock in wheat in Europe, and I shall be glad to give the results later. Sulphate of iron can be obtained from Messrs. Freudenberg & Co. at a cheap rate, and the solution is made by dissolving it in water, cold or warm, in old iron or wooden vessels. When the latter are used, some rusty nails or old hoop iron shall be put in to reduce the ferric sulphate to the soluble ferrous salt." In a further report, and in reply to an inquiry as to whether sulphate of copper will not do as well as the iron salt, Mr. Bamber writes:—"It may possibly do better, but it is more expensive. Further experiment appears to show that common salt is the most promising agent for getting rid of grass on roads. If this proves correct, it would be the cheapest material to apply. I would suggest trials with 10 to 20 per cent. solutions."

A disease on nutmeg trees at Weligama is reported by the Government Entomologist to be due to *Lecanium expansum*, a large scale insect, with which is associated a black fungus which subsists on the "honey dew" secreted by the insect. "The fungus does not injure the leaves to any appreciable extent, but the scaly bug sucks the sap of the leaves and may cause a partial fall of the foliage. This insect occurs very commonly on the nutmeg tree. It has been present in one tree in these Gardens (Peradeniya) for many consecutive years without appreciably affecting the health of the tree. The treatment for such scale insects is by spraying with kerosine emulsion or MacDougall's insecticide, but it is doubtful whether the treatment will repay the cost.'

Messrs. C. & A. Bohringer, in reply to an inquiry made on behalf of a correspondent, state that they are buying

pure well dried *papaine* at Rs. 5 per pound, if up to their analysis.

The Government Agricultural Chemist reports as follows on a sample of Sumatra *tobacco* grown in Jaffna by Mr. V. M. Muttukumaru :—"The leaves have a good sweet and mild aroma, and are of a good size and fairly uniform colour. The texture, however, is far too brittle, breaking at the slightest touch, which renders them unfit for wrappers. Some also have several holes in them, apparently the result of insect attack, and this again renders them useless for the above purpose. These defects, and the coarseness of the midrib, could no doubt be remedied by cultivation and better methods of drying and fermentation; but in its present form the tobacco cannot compare with the wrapper leaf of Sumatra, except perhaps as to the aroma."

Samples of soil taken in the Batticaloa District have been forwarded to the Government Agricultural Chemist, at his request, and his report is awaited.

Mr. E. E. Green, Government Entomologist, reporting on specimens of root-galls on a Cucurbit, says :—"I have examined the specimens of nodular roots of the Cucurbit, and find that they are the result of infection by the 'root-gall worm' (*Heterodera radicicola*). It will be advisable to give this land a heavy dressing of lime and leave it fallow for several months, or to plant it with some product that does not attract the nematode. An application of vaporite would probably act more quickly than the lime and permit of recultivation after a shorter interval. In any case, a rotation of crops would be advisable before replanting with any cucurbit." In this connection it may be mentioned that Mr. Green's recommendation of vaporite for termites has proved useful in the Balangoda district, whence the following report comes: "The vaporite has done much good in the way of ridding us of the white ant in our vegetable beds, and a further supply of it would be most welcome."

With reference to the query raised as to the value of iron sulphate as a weed eradicator in paddy cultivation, the Government Agricultural Chemist writes :—"Spraying with sulphate of iron has long been known as a good means of destroying weeds, especially charlock in grain crops. The reason given for its non-injury to the growing corn is no doubt correct, and if the paddy has the same waxy covering, experiments might well be tried with air prospect of success, as the cost of sulphate of iron is small. A 20 per cent. solution at 100 or 120 gallons per acre is the quantity recommended. The following precautions are necessary:— (1) To spray in fair weather, when the water is off the fields; (2) to cover the leaves of the weeds as completely as possible.

"One of the main reasons why broadcast paddy yields less per acre than transplanted paddy is that the weeds have a greater start over the paddy, and the irregularity of the latter makes weeding more difficult, if not impossible. Spraying would therefore be of considerable advantage, but would not tend to encourage transplanting, which is evidently the best method of cultivating paddy. There should be no difficulty as regards water, but only hand machines could be employed."

In August Mr. R. Paramananda reported that he sustains considerable loss through a disease called "Karuthandu," which attacks tobacco in the Trincomalee District. He states that the disease begins in the nursery and shows itself in different ways when transplanted. In some cases blisters first appear on the leaves, and later on the stems, after which the tree begins to decay. In other cases the disease seems to start from the roots. The following is the Government Entomologist's opinion and recommendation on this report:—"From the symptoms described in the letter of your correspondent, it is evident that more than one disease has been confused under the name of 'Karuthandu.' Specimens should be submitted for determination. To expel subterraneous insects and worms mix vaporite with the soil before making up the nursery beds or putting out the plants. It should be applied at the rate of 1½oz. per square yard, and well mixed with the soil some three or four days before planting. The most serious disease of tobacco in Ceylon is the stem-borer (described and figured in the *Tropical Agriculturist* for March, 1909, p. 177). The only treatment for this is to pull up and burn all the affected plants."

The Secetary, *Wellaboda Pattu* Branch, forwarded a specimen of diseased bandakka (*Hibiscus esculentus*), upon which the Government Entomologist reported as follows:—The plant, as received, was very much withered. The ends of the branches appeared to be dead, and some of them had died back to the main stem. On splitting open the dead branches, a small irregular tunnel was found running down the pith. In one such tunnel the living larva of a moth (probably a *pyralid*) was found. This boring

insect is probably the cause of the disease. It is impossible, at present, to determine the species of the borer. It is being kept in the hope that it may complete its transformations; when it may be possible to give it a name. In the meanwhile, the best treatment will be to prune out any branches that appear to be withering, or—in the case of badly diseased plants—to cut out the plants and burn them."

On specimens of cankered bark, which the Secretary found on some fine orange trees at Meetiyagoda (Ambalangoda district), Mr. Green wrote:—"The cankered areas were swarming with a species of mite; but it is improbable that they had anything to do with the condition. The bark was evidently attacked by some fungus. Mr. Petch agreed with me, but could not determine the fungus as it was not in a recognizable stage of growth. The best treatment would be to excise the diseased spots."

A paragraph in the local press having drawn attention to the damage done to coconuts by a plant louse in British New Guinea, the Secretary communicated with the Director of Agriculture, Territory of Papua, who replied as follows:—"So far as the British portion of New Guinea is concerned, I have no hesitation in saying that the statement is devoid of all foundation. We have an estimated area of 355,000 acres of native-owned and plantation coconuts, and I have never seen or heard of a single tree in the Territory having been killed by the disease. Inquiries from planters and others have failed to reveal the slightest trace of the disease referred to."

The Government Veterinary Surgeon reports as follows in reply to an inquiry from the Eastern Province for improving the breed of poultry there:—"If required for the production of good layers I would recommend Minorcas or Leghorns; if for table birds Plymouth Rocks or Wyandottes."

Fodder.

The Under Secretary for Agriculture, Brisbane, has kindly furnished the Secretary with further information about the "white mangrove," an analysis of which was given in the *Queensland Agricultural Journal*, as that of a good fodder. It turns out to be *Avicennia officinalis*, a fairly common tree in Ceylon.

The following is the analysis by the Queensland Agricultural Chemist:—

	Per cent.
"Dry substance in green material	43·10
Moisture	16·75
Ash	9·87
Fibre	18·02
Carbohydrates (by difference)	35·86
Fat and oil...	1·82
Protein (nitrogen × 6·25) ...	8·68
Total nutrient matter ...	46·36
Albumenoid ratio... ...	1 : 7·2

"From the analysis it will be seen that these mangrove leaves are quite a valuable fodder. The leaves could undoubtedly be mixed with other materials, and also used by themselves for making ensilage."

"It may be added that the nutritive value of other foods—dry matter—has been recorded to be as follows:—Medium hay, 18 per cent.; alfalfa hay, 23 per cent.; oats, medium quality, 49 per cent.; maize, 70 per cent.; peas, 59 per cent.; linseed cake, 56 per cent.; potatoes, 20 per cent.

"The green mangrove is likely to possess a greater feeding value than the dried leaves."

Mr. J. F. Jowitt asks us to correct the botanical name of Congayum grass which last month on his authority was given as *Cenchrus biflorus*, Roxb.

He writes as follows: "It appears that in 1887 this grass was identified in India as *Pennisetum cenchroides*, Rich. Mr. Lock kindly looked up the synonyms of this grass in Index Kewensis; under *Cenchrus* there are seven and under *Pennisetum* five.

"In Flora British India this grass is described as *Cenchrus mutabilis*, Wight ex Hook, and I do not think we can do better than adopt that name for Congayum grass in Ceylon.

In Agricultural Bulletin, No. 27 of 1908, issued by the Department of Agriculture, Madras, there is a lengthy reference to this grass, which is said to be extensively cultivated in Southern India, and highly valued there. As a rule, it is cultivated as a catch crop and treated as an annual, but it may be allowed to occupy the ground for a number of years like our Guinea grass, and used either for pasture or for soiling, but seldom for hay. Cattle are not allowed on to new fields till at least six months after sowing. If cut, three or more cuttings could be got in a year, and a total of approximately 2½ tons green grass secured per annum. The grass was considered by the Principal of the Agricultural College at Saidipet, after twelve years' experience, one of the hardiest of fodder grasses. It is usual in villages

to securely fence the grass fields against cattle trespass by fences made of mulkillivai (*Balsamodendron Berryi*), a tree extensively employed for fencing in the Jaffna Peninsula.

The only possible apprehension in introducing the grass into Ceylon is the possibility of its proving a weed in cultivated land; but, as Mr. Jowitt states, there does not appear to be the same danger to be feared from *Cenchrus mutabilis* as from *Cyperus rotundus*. The bulletin referred to mentions that the vitality and propagating power of the grass are remarkable, but as the roots are very short it can be cleared off the land without much difficulty. This opinion, compared with that of Duthie, that the grass is "a most excellent fodder, thriving best where the soil is sandy," gives a good character to this new introduction. For long the great cry from the dry districts has been for a drought-resisting fodder grass, and here is one at last. Those who wish to see how freely *Cenchrus mutabilis* grows can do so at the Government Stock Garden, and any one wishing to lay down the grass in the drier parts of the Island should apply for seed to the Secretary, who is expecting a large consignment in March next in time for planting during the south-west monsoon rains.

Errata.—In Progress Report No. XLVI., for *Phalaris gayana* (Rhodes grass), read *Chloris gayana*, Var.

Miscellaneous.

The description of a *mechanical polisher for cacao*, known as *Barnard's patent*, referred to in the *West Indian Agricultural News*, was sent to a well-known local cacao planter, who writes:—"This will not help us in Ceylon, as we wash before drying and do not clay after fermenting as is done in some places. We do our drying in special rooms with fans and heaters."

The Superintendent of School Gardens has forwarded an excellent report on the work going on at the *Weragala School Garden*, which is said to be one of the best in the Kegalla district. He says:—"The whole place is under systematic management, and the work well organized. The teacher is of a type not often met with, and has the children under good discipline and careful instruction."

Mr. K. Bandara-Beddewela has forwarded to the Secretary an interesting memorandum on *fruit cultivation* as carried on by him in the neighbourhood of Kandy.

Mr. James Perera of Molligoda has forwarded a specimen of a *fancy curtain* in imitation of those imported from Japan, and made entirely of local materials. The article is submitted for inspection of members.

C. DRIEBERG,
Secretary.

December 18, 1909.

REPORT OF THE COMMITTEE ON MODEL AND EXPERIMENTAL GARDENS.

(*Submitted to the Board, Dec. 18th, 1909.*)

The Sub-Committee consider that there is no reason for anxiety on the score of expense. They think it very unlikely that a larger sum than Rs. 18,000 can be profitably spent on model gardens within the next five years. Even if the whole of this sum is spent at once the Society will still be left with a balance sufficient to defray the cost of an experiment in Tobacco Cultivation and Curing. The Committee therefore recommend that a sum not exceeding Rs. 18,000 be voted by the Board to be used as grants-in-aid for the establishment of model and experimental gardens in the different Provinces.

2. It is recommended that grants should be made under the conditions laid down in the annexed statement, each garden to be under the management of a genuine Branch Society represented by a properly appointed Secretary.

3. A proper account of all experiments should be kept by the Secretary of the branch society, showing the area of ground devoted to each experiment, the cost of seed, manure, &c., used and the amount and value of the labour employed. These details, as well as the results of each experiment, should be recorded in a book kept for the purpose, and the proceeds of sale of any crops should be shown as a set-off against the cost of growing.

4. As regards the profits which may be expected to accrue from the sale of certain crops, the Committee recommend that, should any garden show a surplus at the end of the year, such surplus should be placed on deposit with the Parent Society to form a fund to be used for the ultimate benefit of the Experimental Garden Scheme.

5. It is further recommended that a permanent Advisory Committee be appointed to discuss what plants should be grown and what experiments made at each garden, and that a programme of the work to be carried out at each garden should be submitted periodically for the approval of the Committee.

6. It is thought that each garden should be made as far as possible the headquarters of an Agricultural Instructor, and with this end in view it is anticipated that at least two additional Instructors will be required. The appointment of one Instructor for the Sinhalese and one for the Tamil districts is recommended as soon as duly qualified candidates are available.

7. Each garden should be provided as early as possible with at least one labourer who has undergone a brief training in simple gardening operations at Peradeniya.

8. In order that the use of machinery may be demonstrated, machines, bulls and drivers should be provided by the Parent Society, which could pass in circuit from one garden to another—cost of upkeep for the time being to be paid by each garden in turn.

9. As regards existing gardens receiving grants from the Society the Committee are of opinion that each case should be considered on its merits. At the same time they desire to discourage grants by the Society to gardens worked by individuals.

10. The suggested conditions under which grants to experimental gardens should be made are attached.

R. H. LOCK (*Chairman*).
BERNARD SENIOR.
A. KANAGASABAI.
H. MARCUS FERNANDO, M.D.
W. A. DE SILVA.
S. D. BANDARANAIKE.
W. D. GIBBON.
C. DRIEBERG (*Secretary*).

CONDITIONS FOR ESTABLISHING MODEL AND EXPERIMENTAL GARDENS.

1. The Ceylon Board of Agriculture is prepared to make grants-in-aid to local Societies for the establishment and maintenance of Experimental Gardens for the next five years commencing from July 1, 1910.

2. Applications for such grants-in-aid will be received by the Secretary of the Board of Agriculture up to March 31, 1910. These applications will be considered by the Advisory Committee on Model and Experimental Gardens.

3. It is proposed for the present to subsidise one garden in each Province.

4. The Parent Society will give in the first year an initial grant not exceeding Rs. 1,000 for the starting of a garden, and an upkeep grant not exceeding Rs. 200 per annum for five years *on condition that the local Society will contribute sums not less than those granted.* These sums may be exceeded in the case of certain provinces should funds become available through failure of the scheme in others.

5. Gardens established under this scheme should not as a rule be less than 5 acres, but in no case will any site less than 3 acres in extent be allowed. They must be within easy reach of some public road, and the sites must be approved by the Parent Society.

6. The land should either be purchased outright or leased for a period of not less than five years, and be available for the sole use of the garden.

7. The funds contributed by the local Society for the working of the garden should be deposited with the Government Agent of the Province, either in a lump sum annually or in instalments; and the Society's grant will be similarly deposited with the Government Agent on intimation being received of the deposit of the Local Society's contribution.

8. The garden will be under the supervision and control of the Parent Society, and cultivation and experiments will be conducted according to a scheme to be drawn up by the Advisory Committee.

9. Proper accounts of all expenditure, with receipts, should be kept on an approved system by the Local Societies, and a copy of such accounts forwarded to the Parent Society half-yearly. The books shall be open to the inspection of officers of the Parent Society.

10. The Local Society should be properly represented and controlled by a local board, with the Government Agent of the Province or the Assistant Government Agent of the District as its Chairman.

PROPOSED EXPERIMENTAL TOBACCO CULTIVATION.

FINAL REPORT OF THE SUB-COMMITTEE.

(*Submitted to the Board, Dec. 18th, 1909.*)

The Committee have re-considered the resolution submitted to the Board at the last meeting, together with the amendment then proposed.

The Secretary of the Society has been in correspondence with the Agricultural Departments of the United States of America, Philippines, Cuba, and the Transvaal, with a view to ascertaining:

(*a*) Whether a fully qualified expert could be obtained from some country outside Ceylon, and

(*b*) Whether an institution exists at which a probationer recruited in Ceylon

could receive a thorough training in the scientific treatment of tobacco cultivation and curing.

With regard to (*a*) the only suitable expert whom the Committee hear of as being available is Mr. A. VanLeenhoff, Tobacco Expert to the Transvaal Department of Agriculture. Mr. Leenhoff is understood to be willing to leave the Transvaal for a permanent position in the tropics accompanied by increased emoluments. Mr. Leenhoff's presenc salary is £1,000 per annum.

The Committee is of opinion that the present prospects of the tobacco industry in Ceylon do not justify a permanent expenditure on the scale necessary to secure the services of Mr. Leenhoff.

With regard to (*b*) the Committee learn that students at the State University of Lexington, Kentucky, are at liberty to attend special courses in tobacco cultivation as part of a four years' training for an Agricultural Diploma. After careful consideration of the arguments adduced at the special meeting of the Board, the Committee have arrived at the conclusion that the project of sending out a student from Ceylon to undergo such a training is not to be recommended owing to considerations of time and expense.

At this point the Committee entered into communication once more with Mr. Edward Cowan, and it was found that he was willing to supervise an experiment at Maha-iluppalama, making periodical visits and a continuous stay when necessary—for a fee of Rs. 3,000 for one year and a commuted allowance of Rs. 500 and a free railway pass between Nanuoya and Talawa—with leave to retain his present appointment.

The Committee consider the fee now asked by Mr. Cowan to be decidedly moderate. They consider that the experiment should be carried out, if it is carried out at all, without further delay, and they consider that an experiment extending over a year will provide a satisfactory test as to whether a high grade of tobacco can be grown at a profit in such a situation as Maha-iluppalama.

The Committee accordingly recommend:

(*a*) That a sum not exceeding the amount of Rs. 27,500 already voted for the purpose be expended upon an experiment in Tobacco Growing and Curing for one year at Maha-iluppalama.

(*b*) That Mr. Cowan be appointed to supervise the experiment on the terms referred to in para 5.

(*c*) That Government be requested to provide Mr. Cowan with a free railway pass between Nanuoya and Talawa, during the period of the experiment.

Mr. Cowan's estimate of expenditure—a copy of which is annexed—shows that the experiment can be carried out with the funds now in the hands of the Society, and at the same time leave a balance amply sufficient to defray the expenditure on a scheme for the establishment of Experimental Gardens.

In the meantime, in view of the necessity for commencing operations at once, owing to climatic considerations, His Excellency the President of the Board has been asked provisionally to sanction a commencement at once on the lines above indicated.

R. H. LOCK.
BERNARD SENIOR.
A. KANAGASABAI.
H. MARCUS FERNANDO.
M. KELWAY BAMBER.
EDWARD COWAN.
JOHN D. VANDERSTRAATEN.
C. DRIEBERG.

RECOMMENDATIONS ADOPTED.

H. E. the Governor: Members will see from this report that the Committee have gone into the matter quite thoroughly, and the result of their enquiries has been that they recommend to the Society that Mr. Cowan should be engaged at a fee very much less than that originally mentioned which would have practically swamped the vote. Mr. Cowan is at present going to retain his present post and carry on the experiment, keeping watch at Maha-ilupalama, and continue there, when necessary, on receiving a moderate fee of Rs. 3,000 a year which will leave us quite a good sum to carry on the experiment. I think I had better read these items of expenditure:—

TOBACCO ESTIMATE 50 ACRES.

	R. c.
Cooly pay and rice 100 at 40 each	14,600 00
Superintendent's fee ...	3,500 00
Conductor's	650 00
3 drying sheds (1 to be used for F. shed) ...	3,500 00
Tools, 1 mamotie, 1 rake, 1 W. can per cooly) ...	350 00
Planks for shading 150,000...	200 00
Seed, string, needles, mats ...	1,000 00
Leaf baskets ...	200 00
Mats for stapling and baling ...	300 00
Contingencies, including 1 baling press ...	2,000 00
	R26,300 00

(Sgd.) EDWARD COWAN.

Dessford, Nanuoya, Nov. 16th, 1909.

Dr. H. M. Fernando moved that the recommendations of the Tobacco Committee be adopted.

The Hon. Mr. F. C. Loos seconded, and the motion was carried.

THE CEYLON AGRICULTURAL SOCIETY.

MEMORANDUM ON A TOUR IN SOUTH INDIA (Nov. 29—Dec. 17, 1909).

Read before the Board of Agriculture, December 18th, 1909.

Believing that it would be a good thing to show some of our Instructors the work going on at one or more of the Agricultural stations in India (which with the enormous resources it commands and the settled policy it has adopted, presents special opportunities for study to those who are concerned with the improvement of native agricultural methods), I conceived the idea of conducting a short tour in Southern India accompanied by the two senior Instructors; and I feel grateful for the sanction which H. E. the President gave to my proposal that we should visit the Koilpati Agricultural Station and the Home Farm at Sivagiri.

The futility of attempting to effect agricultural reforms among a conservative people, wedded to

THE SETTLED PRACTICES OF AGES,

by the wholesale introduction of the methods and appliances of another nation with which they have little in common, has been proved too often. The more rational policy is undoubtedly an evolutionary one which seeks to bring about the gradual improvement of existing methods and appliances. The Imperial Agricultural Department of India, working on these lines is endeavouring in the first instance to spread a knowledge, and popularise the practice, of all that is best in the Empire before looking to outside sources for means of improvement, and it is surprising how much good work has been done in this way.

I selected the two stations referred to above owing to the fact that the one illustrates the system of cultivation recommended for dry lands, and the other for wet lands.

The Koilpati farm is conveniently situated about a mile from the Railway station of the same name. This institution is one of three working under Mr. H. C. Sampson, Deputy Director of Agriculture for the Southern Division of the Madras Presidency, whose headquarters are Trichinopoly. Of the other two stations one is at Palur, a

CENTRE OF THE GROUNDNUT AREA,

and the other at Talliparamba in the Malabar country where the principal crops are paddy and pepper. Koilpati is the centre of an important cotton district.

The permanent staff at the station consists of a Manager, two assistants, and a clerk, besides watchers, overseers, and coolies.

The farm is 140 acres in extent, and is made up of a black soil tract of 115 acres, and a red soil of 25 acres. The farm stock consist of 8 pairs of working bulls, chiefly Congayum cattle, noted for their strength and endurance, and costing from Rs. 150 to Rs. 250 a pair.

The station is allowed an annual vote of Rs. 5,000, more than half of which is recovered in one way or another. The average rainfall at Koilpati is 25 inches. The implements used are of the simplest description, consisting of the country plough and three other appliances employed in the Northern districts, viz., the seed drill or "gorru," the blade cultivator or "guntaka," and a combination of blade hoes called the "Dantalu."

The ordinary method of cultivation by the ryòt is entirely dependent on the plough which is used to prepare the land for sowing, cover the seed, and for stirring the soil and thinning out after the plants are up.

By the use of the three other implements named much more

SYSTEMATIC AND SATISFACTORY WORK

is possible. The seed drill enables the seed to be sown in straight rows in narrow furrows opened out by the tines running in front of the tubes (of bamboo or tin) through which the seeds are dropped. The drill is constructed to sow from 2 to 6 rows, and is worked by a pair of bullocks, a driving man and a boy feeding the seed. After the drill comes the blade cultivator which acts as a harrow and covers the seed.

The blade hoes are employed for weeding and stirring the soil while the crop is growing, the regular sowing allowing of inter-cultivation resulting in a soil-mulch which is so important a provision in dry cultivation. A set of these implements—which I have secured—costs only Rs. 15 on the spot. They are easily made and repaired, and should at least serve us as models.

The station is chiefly concerned with the

IMPROVEMENT OF COTTON CULTIVATION,

and the importance of this work may be judged from the fact that there are about 1¾ million acres under this crop in

the Madras Presidency, while the Tinnevelly district produces about ¼ of the cotton yielded by the whole Presidency.

Cotton is sown with the N. E. Monsoon (*i.e.*, in September-October) which begins with copious rains that gradually diminish in December, while the period from January to March is comparatively dry. This distribution of rainfall allows time for the proper setting of the main crop, while the N. E. wind is reckoned on to ripen the cotton and burst the pods. The picking generally begins in February. The April-May rains, as a rule, produce another flush of blossoms which yield a second or "summer" crop. Occasional heavy rain is to be preferred to frequent light showers. By June the crop is over and the preparation of the land for the next season follows.

Two kinds of cotton are commonly cultivated, the produce of which is known as "Tinnies," viz., "Karangani" which is indigenous and "Uppam," a naturalised species. The former is classified as *Gossypium obtusifolium* and the latter as *G. herbaceum*. The aim of the cotton operations on the farm is directed towards producing a

UNIFORM LINT OF IMPROVED LENGTH

and quality and a higher yield. To this end plant-breeding and selection, and better methods of cultivation and manuring are being carried on. As the supply of superior Karangani seed does not suffice to meet the demand, seed-farms have been established in convenient centres. These farms, if worked entirely by the Department, would naturally cost a great deal, for which reason an arrangement which is of mutual benefit to the cultivator and the Department is resorted to. The Department selects what is considered to be a suitable site in a village, and enters into an agreement with the owner to carry out the object it has in view. On the one side

SEED AND IMPLEMENTS ARE ALLOWED FREE

by the Department which pays the assessment rate and also gurantees to purchase the seed cotton at Rs. 4 per candy of 500 pounds above the market price. The implements it is sought to popularise are worked by the station farm hands, and the crop is thus cultivated according to the most approved system.

The ryot on his side is expected to do the preliminary work of ploughing, manuring by penning sheep and weeding, and also supply cattle. By this arrangement the Department carries on demonstrations in the working of implements, proves the value of better methods of cultivation, and, at the same time, secures a supply of good seed for distribution. The farm labourers are men who are taken from among the ryots themselves, and are made the effectual means of proving the advantages of the

METHODS AND APPLIANCES RECOMMENDED BY THE DEPARTMENT.

It may be thought that the terms offered to the ryot in connection with these seed-farms are too liberal, but such terms are necessary at first if any reform is to be effected. A niggardly policy under such circumstances is only calculated to defeat the object it has in view. Gradually, however (as is indeed the case at Koilpati) the concessions may be withdrawn as confidence is gained in the methods and appliances recommended by the Department. Already the ryots are adopting these, and as the prejudices of one locality are overcome the scene of operations is shifted to another.

Authorities do not seem to be agreed as to the seed-rate for cotton. The West Indian Department advises 6 lbs. for Sea Island and Mr. McCall 48 lbs. for Egyptian. At Koilpati for drill sowing 10 lbs. are considered as ample and leaving a good margin for thinning.

Various tests are being carried on as regards seed rate, depth of cultivation, spacing, and manuring.

IN THE MANURING EXPERIMENTS

acre plots have been treated with cattle manure as conserved by the ryot as well as according to improved methods. The ryot collects his manure either in exposed heaps or pits, interlayering it with silt, while the more approved means of storage are the loose box system, in which the manure is collected *in situ* in a loose box and covered over each day with a layer of litter, and the byre-pit system in which the manure and litter are removed daily and collected in a covered pit. Manuring with artificials is also being tried.

THE TWO CHIEF CEREAL CROPS

of the district are Cumbu (*Pennisetum typhoideum*), and cholam (*Sorghum vulgare*). Cumbu, the favourite grain crop of the ryot, is being grown on the farm in combination with various legumes, *e.g.*, dhall, lab-lab, cluster bean, and sunn-hemp). New varieties from the Transvaal are also being tried. The fodder from Cumbu is reckoned to be poor.

Ragi (*Eleusine coraccana*) our "Kurakkan" is also cultivated to a considerable

extent, and is being grown at the station in depressed beds as well as on ridges with a view to demonstrating that the former is the better method for "summer" and the latter for "winter" cultivation.

Cholum (*Sorghum vulgare*) is very extensively cultivated in the district as a fodder, for which purpose it is sown very thick.

A SERIES OF EXPERIMENTS ARE IN PROGRESS

with eighteen varieties, to ascertain which are best for fodder and which for grain. The proper rate of sowing is also the subject of enquiry. The ryots sow about 40 up to 100 lbs.; on the farm rates varying from 8 to 20 lbs. are being tried, The best period for cutting for fodder is another matter being looked into. The practice of growing fodder for cattle is one that cannot be too highly commended, showing as it does that the cultivators place a proper value on their stock. The result is that they keep only as many animals as they need and can feed and look after properly. Cattle are always tended, and fields are seldom fenced. Sorghum fodder (dried into a kind of hay) is highly esteemed and fetches a good price.

Various other crops are being

RAISED FOR SPECIFIC PURPOSES,

e.g., cow-peas, to ascertain the best varieties for fruit and for green mature, *Dolichos lablab* as a soil renovator and smother crop, and so on.

A very interesting object lesson was furnished by the onion plantation in propagating (1) with seed-bulbs, (2) with bulbs from seedling plants, and (3) with seed from a succession of seedling plants. The results were most strikingly in favour of the last system. The method of cultivation was also well worth studying.

The instructors were given every facility for seeing the working of the various farm implements. They also had an opportunity of seeing the

TRAPPING OF GRASSHOPPERS ON DRY LAND,

and of paddy-flies on wet land by means of the bag recommended by Mr. Lefroy.

The Koilpati agricultural station is well organised and efficiently managed. The experiments are carefully arranged and carried out on a sufficiently large scale to give them weight. The demonstrations are conclusive and appeal to the visitor. The work on the farm is influencing the operations of the ryot. I congratulate the Deputy Director and his staff on these results.

Sivagiri, says Mr. Lonsdale, the Agricultural Expert, in one of his reports, is 12 miles as the crow flies from Sankuranakoil, but

IN THE ABSENCE OF ANY MEANS OF AVIATION,

I found it 43 miles by bullock carts from Satur railway station; and when it was stated that this same road had to be traversed on the return journey, it is hardly necessary to add that the Home Farm is not very conveniently situated for visitors.

The Farm consists of 281 acres, of which 253 are under wet cultivation. It is prettily situated at the foot of the Western Ghauts, beyond which lies the State of Travancore.

It is best known for its successful results in paddy growing, and was, therefore, I reckoned, a suitable place for my Instructors to visit. This success, as Mr. Lonsdale himself admits, is to a great extent due to the labours of the Farm Superintendent.

The Sivagiri plough, of which I have secured a sample, is used both on dry and wet land, and is now being adopted by many cultivators in the Tinnevelly district. It is simple in structure, weighs about 24 lbs., and costs on the spot only Rs. 6. These

PLOUGHS ARE MADE ON THE FARM

under the eye of the Superintendent, and my Instructors not only had opportunity of taking part in a ploughing demonstration, but also in seeing how the ploughs are made.

On the 5th instant the extensive paddy tracts were visited and the different operations in progress carefully followed. Here wet land ploughing, the method of applying green manure raised *in situ*, and the transplanting of single paddy seedlings were watched.

The farm has done much to encourage the use of green manure by inducing cultivators to sow "Kolingi" (*Tephrosia purpurea*) as soon as the paddy crop is harvested, about March-April. The

GREEN MANURE IS WORKED INTO THE LAND,

when it is ploughed again in September-October.

Tephrosia, the Sinhalese 'pila' and Tamil 'Kavalai' is a common weed on waste lands. To prove its value, and to meet the demand created by the successful operations on the Farm, the Superintendent by offering a measure of paddy for one of thrashed 'Kolingi' seed, has collected large quantities. In

THE RECLAIMING OF SALINE LAND

it has been found a good plan to dig in 'Tephrosia' till the land is able to grow the plant itself and ultimately support other crops.

Another green manure recommended is sunn-hemp (*Crotalaria juncea*), our 'Hana,' which gives a crop within eight weeks, so that it may be sown much later and almost at the regular ploughing seasons. It is recorded that paddy land which was never known to yield more than 700 Madras measures (about 32 bushels) per acre, had its yield increased to 1,225 measures (about 55 bushels) by a dressing of sunn-hemp raised in the field. This crop has the additional recommendation of being an excellent fodder, and even if the stalks are cut for that purpose, is found to leave the land enriched.

The results of

PADDY CULTIVATION AT THE FARM

as given by Mr. Lonsdale in the *Agricultural Journal of India* are interesting, and to many in Ceylon will be startling. He says: "The value of the average yield of each of the 252 acres, viz., 1,340 Madras measures, was Rs. 210·10. The cost of production was also carefully worked out. As practically the whole of the Farm receipts are obtained from paddy, the whole working expenses of the Farm were charged to paddy. The cost of production of the 1,340 Madras measures (the average yield per acre) being approximately Rs. 37·00, the net profit per acre was Rs. 83·10."

Among other interesting work going on is

SEED SELECTION WITH PADDY.

The finest ears are picked out from the best fields at harvest time. These are threshed separately. Care is taken to pick out ears true to variety and free from diseases with the grains fully ripe and closely set. One of the chief objects in selecting is to increase drought-resisting properties. Except in the case of very sandy and poor soils, the dry cultivation of wet lands is found to have a very good effect. Anticipating the objection to breaking up the sward on paddy-fields, Mr. Lonsdale says: "More is lost in paddy than is gathered in grass, and the shortage in grass must be replaced by the growth of some fodder such as sunn-hemp."

The inspection of the seed store, the examination of various kinds of paddy, and the discussion of their properties occupied the morning of the 5th, and may result in the

INTRODUCTION INTO CEYLON

of some suitable varieties. I have secured samples of the best kinds of which large quantities could be obtained if desired. Spacing and irrigation requirements are also being studied. The planting of one or more seedlings in a hole and at varying distances has gone to show that the single seedling method is the best. As regards irrigation the results of experiments has proved that a

GOOD DEAL OF WATER IS WASTED

under ordinary conditions of cultivation, and that quite as good crops have been obtained in many cases with 30 as with 60 of water, provided the small quantity is used judiciously.

Mr. Lonsdale has found that, if wet lands are ploughed in the dry state, even a month before they are to be brought into a puddle, the weeds will have been killed and will not require drowning with water, much of which is allowed to run to waste; and further, that paddy irrigated and then allowed to become almost dry between each application of water can withstand drought for a longer time than under ordinary conditions.

Among other crops rasied on the Farm are sugar-cane, which yields a handsome return, and plantains—set out 1,000 to the acre and kept as single plants—besides a variety of grains and pulses.

Altogether the work going on at Sivagiri was full of interest, particularly the systemetic way in which green manuring is done in connection with paddy cultivation, by growing *Tephrosia* on the land. At the time of our visit there was a tract of over 20 acres carrying a heavy growth of this legume, ready for ploughing in before preparing the land for paddy.

At the end of the ten days to which the sanctioned tour was limited, I was to have entered upon a week's holiday, but the Instructors, having had their appetite for travel and study whetted, pressed for a few days' leave to enable them to visit

ONE OF THE CENTRES OF FRUIT CULTIVATION,

and under the special circumstances I acceded to the request. After discussing Salem and Bangalore, I decided in favour of the latter as being *par excellence* the fruit garden of Southern India, where the flora of East and West blend with astonishing familiarity. The time spent in Bangalore was fully occupied in visiting gardens and nurseries—studying methods of propagation and cultivation, and noting the conditions under which the high grade produce, for which the district has become so famous, is raised—from apples

and grapes to oranges and mangoes, and from potatoes and cauliflowers to brinjals and chillies. A day was given to the

MYSORE FRUIT SYNDICATE'S FARM

of over 40 acres, where especially selected strains of fruits are being cultivated according to the most up-to-date methods, and three visits paid to the State Botanical Gardens, which, under its new Superintendent, Mr. Krumbiegel, is fast developing the economic side of horticulture. These experiences presented opportunities which it would have been a pity for the Instructors to have altogether missed, as they would, had they terminated their tour at Satur; and personally I am glad—even at the cost of my holiday—that I accompanied them to Bangalore, and showed them much that should prove useful to them in their sphere of work in Ceylon.

MR. DRIEBERG THANKED.

H. E. the Governor: I am sure members will agree with me that we are very much indebted to Mr. Drieberg for having passed his holiday in such a very useful manner, and having furnished us with the remarkably able memorandum which he has just read. (Applause.) It is full of practical remarks, and shows that he has certainly exercised his powers of observation to the maximum extent. I think I am voicing the views of this meeting when I say that our hearty thanks are due to Mr. Drieberg for his paper. (Applause.)

REPORT ON SCHOOL GARDEN SHOW:

HELD AT MIRIGAMA SCHOOL, 30TH OCTOBER, 1909.

Fruits.—There was a comparatively large number of entries in this class, and the quality of the exhibits was generally good. Oranges, limes and woodapples of good quality were much in evidence; but, contrary to what might be expected, pineapples and plantains were poorly represented. Rambutan, Mangosteen and Durian, being out of season, were of course not entered.

Vegetables.—Of these there was a good miscellaneous display. The most standout exhibits were in the Gourd family, there being very fine pumpkins. Among the "yams" there were numerous grotesque specimens, and the task of the judges in deciding on the best was a difficult one.

Plants in Pots.—These were few in number, but the specimens shown were well grown and of good quality.

The Show on the whole, though the first of the kind held in Ceylon, would compare well with many a village show, and reflected credit on those School Gardens participating in it.

H. F. MACMILLAN, *Co-Judge.*

Royal Botanic Gardens,
Peradeniya, 4th Nov., 1909.

DRY FARMING PRINCIPLES.

(From the *Queensland Agricultural Journal*, Vol. XXIII. I., Part 2, August, 1909.)

From evidence given by practical farmers engaged in dry farming throughout the State of Wyoming, U.S.A., in response to letters addressed to them by the authorities of the Wyoming University and Agricultural Experiment Station, it would appear that, with the employment of proper methods, combined in a measure with stock-raising, dry farming is a profitable enterprise. In that State there are over 14,000,0000 acres of land with a rainfall of over 15 in. per annum. There are nearly 30,000,000 acres with an annual precipitation of between 12½ and 15 in. All the arable land in these areas will grow profitable crops by dry farming in a majority of seasons. Then there are nearly 19,000,000 acres, of which probably one-half receives less than 10. of rainfall.

Under the most favourable conditions crops have been successfully grown on a precipitation of less than 10 in., but still it would be hazardous for a settler to venture much in the hope of gaining a livelihood on a 320-acre homestead when he knew that 10 in. per annum was the average, and that in one-half the seasons it would fall short of that amount.

Total annual precipitation is no conclusive guide in locating districts where dry-land farming can be successfully practised. The quantity and character of rainfall during the growing seasons, together with altitude, length of season, amount and severity of wind, hail storms, early and late frosts, are all factors which contribute to the solution of the question. The heavy dews which frequently occur in Queensland would also be a factor in this State. Now, as to the "Principles of Dry Farming," the first to be considered is—

Ploughing.—From the evidence abovementioned, there seems to be no question of the desirability of having the ploughing done some considerable period before the time of planting, and that the land should be so handled during the fallow period as to render it capable of taking up and holding every particle of moisture possible. Autumn ploughing is recommended, where it can be practised, for spring crops and for seeding the following autumn. Whenever autumn ploughing is done, the ground should be left as rough as it can be, in order that it may catch the snow (that is in Wyoming). For summer tilling, land ploughed in autumn is better; but a summer-tilled ground for an autumn-sown crop may be ploughed early in spring. Where possible, a depth of 8 in. should be maintained, while some advocate ploughing 10 in.

Harrowing.—As a rule, all land should be harrowed almost immediately after it is ploughed, the only exception being autumn-ploughed land, which should lie rough during the winter. As a rule, summer-tilled land should be ploughed after each shower of heavy rain, especially when the storm has compacted the soil in any degree. The harrow should be used on cereal grains in the spring and on cultivated crops, should the ground become encrusted before the crop is sufficiently far advanced to cultivate. The disc or lucerne harrow should be used on permanent meadows and lucerne fields early in the growing season to aerate the soil and mellow the surface to as great an extent as possible.

The Roller.—The roller and the subsurface packer are valuable implements in the hands of the dry farmer, if used with caution. The ordinary smooth roller should be discarded for the corrugated roller, which serves to pack the ground; at the same time it leaves a roughened surface from which the moisture does not readily evaporate. The sub-surface packer performs the same kind of work, and, on fresh-ploughed, mellow soil, may be more desirable. The corrugated roller serves many purposes, and does not leave the hard, smooth surface which seems to encourage rapid evaporation.

Weeder.—The most useful of implements for rapid work in light cultivation is the weeder. This cultivates the surface of the ground to a depth of 1 or 2 in., is operated very easily, and one team can cultivate a large surface in a short space of time. It is practically a light harrow, and does the work much more cheaply than the ordinary harrow, wherever the ground is in such condition that the weeder will penetrate the ground to the necessary depth. For the cultivation of cereal crops, the first process would naturally be to harrow with the ordinary spike-tooth harrow. Following this, one or two cultivations should be made with the weeder, which may operate on fields of grain until the growth is 1 ft. or more in height. It serves to preserve the soil mulch, break the crust, and promote ventilation.

Drills and Seeding.—While all the reports mentioned indicate that a variety of drills have proved successful, it is universally conceded that some form of press drill is necessary to get the best results from dry-land farming. Any means whereby the soil is well compacted around the seed produces the desired result. Rolling the land, however, should be followed by the harrow or weeder, in order that the surface may be roughened and evaporation checked. Where one is compelled to sow broadcast, the corrugated roller is recommended. Even the ordinary smooth roller may be employed to compact the ground after seeding, but the process should be followed at once by some sort of light cultivation.

Crops.—The dry farmer, more than the humid or irrigation farmer, must select and grow crops adapted to his local conditions. The developing of varieties capable of contending with aridity is progressing rapidly. Rotating of crops, conserving and utilising of farm manures, and maintaining a full complement of live stock are essentials to the highest degree of success in dry-land farming. Some of the crops which have demonstrated their adaptability to Wyoming dry-land conditions are—Beardless Barley, Macaroni Wheat, Turkey Red Winter Wheat, Winter and Spring Ryes, Oats, Spelt, Broom Grass, Lucerne, Potatoes, Sugar Beets, and, in the lower latitudes, Indian Corn and Milo Maize.

GENERAL CONCLUSIONS.

The dry-land farmer must continually bear in mind that, in order to succeed, he must study the physical characteristics of his soil, and take advantage of every possible means of conserving all the moisture that falls, whether it comes during the preparation of the land for seeding, during the growing period of the crop, or after a crop has been harvested. The foundation principle of conservation of moisture is to provide and maintain at the

surface a layer of loose soil, which serves to prevent the escape of moisture by evaporation. In the majority of cases it will be necessary to conserve the moisture of two seasons for a single crop; and early, deep ploughing, summer tilling of the land, and so arranging the crops that two seasons' rainfall will be largely utilised for each crop, are the means of securing the desired results. The dry-land farmer cannot afford to be at all careless about any of these operations. He should also remember that every weed allowed to grow in his cultivated crops saps its proportion of the moisture from the land, and thus robs him of a portion of his just dues.

Correspondence.

DEATH BY EATING POISONOUS FRUITS.

DEAR SIR,—The annexed cutting appears in the *Ceylon Observer* of Friday, August 20th :—

"A woman, 30 years of age, of Nugegoda, died in hospital this morning, having eaten poisonous fruits. She went to the jungle to pick firewood, and there was attracted by fruit on a tree. Plucking one she ate it, and finding it tasty, plucked three more and ate them. On returning home a native doctor was summoned, and he advised her removal to hospital. The fruit was called Hondala. The doctors could not cure her and she expired this morning."

"Hondala" is the Sinhalese name for *Modecca palmata*, one of the Passifloraceæ. It is a common plant in the jungles, with a showy orange-coloured fruit containing black seeds surrounded by a sweetish white pulp.

I can speak from bitter experience of the extremely irritant character of the poison, as I very nearly died from the merest taste of two or three seeds. To the best of my recollection, I only bit through the seeds and pulp and immediately ejected them. But within an hour I began to vomit violently, and continued doing so, at intervals of a few minutes, all through that night and—at gradually longer intervals—throughout the following day. The poison then worked lower and caused intense griping and diarrhœa, from which I did not wholly recover for nearly a week.

Yours, etc.,

E. E. GREEN.

PAPER INDUSTRY IN JAPAN.

21-35, Nakamura, Yokohama.

DEAR SIR,—By way of response to an article on the "Paper and Papier Mache in Bengal" by Mr. D. N. Mookerjee, M.A., which appeared in your Magazine of October number, I venture to write on the subject of hand-making bast paper industry of Japan.

Our process of manufacture is essentially same as in Bengal with the exception of some improvement in tools, somewhat larger in sizes of paper made and undoubted superiority of materials used here. Amongst the so-called papermakers there are very few who solely subsist in the avocation, but mostly they are semi-agriculturists even in the noted paper-making districts,—the artisan who produces the finest art paper in the world at least cultivates enough food stuff for his own use. Paper made in cold season is much better, as our vegetable mucilage gets decomposed quicker in warm seasons and the paper is not made all the year round. This change of occupation may do good for their existence, as the paper-maker's lot is hardest drudgery everywhere.

MATERIALS.

(1) Gampi—*Wickstrœmia pauciflora*, shrub attaining 5-8 feet high, growing wild along the southern fringe of Japan in the climate where camphor trees thrive, from the bast the celebrated Japanese copying is made. The pure pulp costs as high as two shillings per lb. The supply is getting exhausted fast, because, if cultivated, the plant loses the original quality and the fibre gets very weak in strength.

(2) *Broussonetia papyrifera* is the most useful plant and extensively cultivated all over the country but requires no attention—three to five years old with stems of an inch diameter at the base, 6-8 ft. high produce the best fibre. Very strong paper is made as is used for the Japanese paper door panels, umbrellas, lanterns; where tension strength is needed no other paper can take its place.

(3) *Edgeworthia papyrifera*,—weakest in strength, but fine paper is made such as the Japanese bank notes, document paper, known as the vellum paper, just like the European imitation paper called the "Japan."

(4) *Hibiscus Manihot* root is used for the mucilage. This requires no after-sizing unless the paper be used for special purposes.

The preceding three principal fibrous shrubs compose the materials of our bast paper. In this age of machinery and science, the hand-making process seems too primitive and tedious in sympathy with general progresses, and the makers have constant struggles against the force and feel sometimes disheartened to meet the demand for exactness in every respect. But, fortunately, whether be it an encouragement or simply a force of habit, our Government made it a rule to use the hand-made paper only for their correspondence, legal forms and all lesson books for the primary schools, as the paper stands better for children's rough handling; besides the manifold uses in toilet and hygienic purposes the hand-made paper is indispensable in Japan for some generations to come.

Mr. Ferdinard Flinsch, the famous German paper-maker, who sent his son here some years ago in order to make the bast paper by machinery, bought several tons of the materials and exported them to Germany; but he did not succeed in devising either suitable machinery or found the supply of the materials too limited and gave up the attempt since. An English paper firm has been contemplating the same project, but stands still at present. Two Japanese makers contrived machinery by which copying paper is being made into rolls of about 20 inches width and sold at about 1s. 6d. per lb., but the paper is weak as compared with the hand-made, and consumers prefer the latter, so very little business is done in the former.

There will be a steady demand for the hand-made paper in Japan so long as people write with brushes and Indian ink. It has a porous rough surface and absorbs ink as one writes. The Japanese architecture requires the paper door which gives the light effect of ground glass and imparts warmth to the house. In some stormless parts of the country we have houses that have the outside shutters made of half wood below and papered upper part. Such paper is usually changed yearly. People pay four or five times higher price for this than for machine-made-paper, yet competition compels the makers to mix 30-50% straw or wood pulp to the detriment of their own interest, and there are worthless hand-made papers on the market. Sentimental people, as we are, must use the conventional kind of paper on all occasions of ceremony, but soon as the consumer find no goodness in the hand-made paper the industry must go to the wall. Genuine quality of the paper is now getting rare; still fine paper can be made for specific requirements. Such is the state of affairs the makers have to contend with, but nevertheless the demand is ever increasing as people progress towards material advancemeunt. One can see a part of the trade in the volume of exports of the paper for the year 1908:—

	lbs.	Value Yen.
Copying paper ...	684,159	428,186
General ,, ...	1,584,326	424,146
Vellum ,, ...	299,768	155,515

or a rough total of 1,133 tons valued £100,000 at an average price of 10d. per lb. Besides, there are innumerable fancy articles made of the bast paper. I myself have been manufacturing leather paper for wall hanging out of the waste paper—gold embossed decoration with painted back ground costing a shilling per square yard. We exported up to nearly £20,000 a year once, but the demand has now dwindled down to about £5,000.

Knowing nothing about the quality of Bengal paper and domestic requirements, I cannot express my opinion. If the nature of fibre be good and the hand-made paper can command four or five times over and above the value of machine-made paper, the industry should be encouraged by administrative policy or other means to revive the art, which otherwise must submit to the force of machinery as is the fate in every branch of industries.

Yours faithfully,
S. IIDA.

THE SUPPLEMENT TO THE

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RUBBER FROM WEST AFRICA.

SOUTHERN NIGERIA.

The following specimens of rubber from Southern Nigeria have been examined recently at the Imperial Institute :—

Funtumia Elastica RUBBER.—Three specimens of this rubber, prepared in biscuit form, were forwarded by the Provincial Forest Officer at Benin City for comparative examination.

'A. Biscuit rubber made from *F. elastica*, under supervision of A H Unwin, Provincial Forest Officer, Benin City.' Weight, 1 lb.—The specimen consisted of rough sheets of rubber, varying in colour from light to dark brown, clean and well prepared. The rubber exhibited good elasticity and tenacity. An analysis of it showed it to have the following composition :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	1·6	—
Caoutchouc	...	87·9	89·4
Resin	...	8·5	8·6
Proteids	..	1·6	1·6
Ash	..	0·4	0·4

8 The rubber was valued at 3s 2d to 3s 4d per lb. in this country, with fine hard Para rubber at 4s 6d per lb. and Benin lump rubber at 2s to 2s 1d per lb. on the same date.

'B. Biscuit rubber made from *F. elastica*, by Igodaro, Deputy Forest Ranger, Benin City.' Weight, 1 lb.—Sheets of rubber similar to sample A, but rougher and darker in colour.—The rubber had the following composition :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	7·1	—
Caoutchouc	.	81·6	87·9
Resin	..	8·3	8·9
Proteids	..	2·3	2·4
Insoluble matter	..	0·7	0·8
Ash	..	0·40	0·43

The specimen was valued at 3s to 3s 2d per lb. in this country, with fine hard Para at 4s 6d per lb, and Benin lump rubber at 2s to 2s 1d per lb.

'C. Biscuit rubber made from *F. elastica* by the natives, and sold by them to the Factory, Benin City.' Weight, 1½ lb.—Coarse sheet rubber of uneven thickness, dark colour, and not thoroughly dried. The rubber was a little weaker than the other samples. The results of the chemical examination were as follows :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	8·4	—
Caoutchouc	..	78·7	85·8
Resin	..	8·3	9·1
Proteids	..	2·8	3·1
Insoluble matter	..	1·8	2·0
Ash	..	0·63	0·69

The rubber was valued at 2s 8d to 2s 9d per lb. in this country, with fine hard Para at 4s 6d per lb. and Benin lump rubber at 2s to 2s 1d per lb.

THE RESULTS

of the investigation show that these three samples of Funtumia rubber are of very fair quality, and it is evident that if prepared in this form the rubber will realise much higher prices than the ordinary Benin Lump rubber. Sample A., prepared under the supervision of the Forest Officer, was the best of the series, both as regards chemical composition and appearance, but was closely followed by B. Sample C, prepared by the natives, contained a larger amount of proteid and insoluble matter than the other two specimens, and the percentage of caoutchouc is correspondingly reduced ; it was also much rougher in appearance and had not been dried so thoroughly. For these reasons its value is a little lower than that of the other samples. The preparation of Funtumia rubber in the form of sheets is a great improvement on the usual native methods, and should be encouraged as far as possible.

BENIN LUMP RUBBER.

Two specimens of this rubber have been examined :—

1) "161 B." Weight, 8¼ lb.—The sample consisted of two large lumps and one thick "biscuit" of rubber, which were dark-coloured and dirty externally, but white, porous and very moist within. The rubber was soft and had a very disagreeable odour ; its physical properties were, however, fairly good.

A chemical examination gave the following results :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	...	22·3	—
Caoutchouc	..	63·8	82·1
Resin	..	6·8	8·7
Proteids	..	5·1	6·6
Insoluble matter	..	2·0	2·6
Ash	..	0·63	0·82

The rubber was valued at 1s 10d to 1s 11d per lb. in this country, with fine hard Para quoted at 3s 5½d per lb. This sample is an average specimen of ordinary "Benin Lump" rubber.

(2) "161 C. Ugege tree and vine rubber." Weight 7 lb.—The samplo consisted of three large and three small lumps, which were all dark-coloured and dirty externally. Some of the lumps were fairly dry throughout, whereas others were white and very moist internally. The rubber was rather weak and "dead"; it had a very unpleasant odour. The results of the chemical examination are given in this table:

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	6 5	—
Caoutchouc	...	58·9	63·C
Resin	..	19.7	21·1
Proteids	...	7·2	7·7
Insoluble matter	..	7·7	8·2
Ash	..	1·57	1·68

The rubber was valued at 1s 6d per lb in this country, with fine hard Para quoted at 3s 5½d per lb. This is a sample of ordinary "dead" Benin Lump rubber, containing a large percentage of resin.

"TUBABIKPAN" RUBBER (*Clitandra Elastica.*)—The specimen, which weighed 5⅜ lb., bore the following label :—

'No. 2. 'Ubabikpan' rubber from *Clitandra, elastica.*" It consisted of 18 "biscuits" of rubber ranging from 3 to 6 inches in diameter, and from ⅜ to 1¼ inch in thickness. The biscuits, which were covered with mould on arrival, varied from brown to black externally, and many of them were white and moist within when freshly cut. The rubber was free from stickiness, and exhibited good elasticity and tenacity. The composition of the rubber was found to be as follows :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	5·2	—
Caoutchouc	..	85·7	90·4
Resin	...	3·8	4·0
Proteids	..	3·0	3·2
Insoluble matter	..	2.3	2·4
Ash	..	0·40	0·42

The rubber was valued at 2s 8d to 2s 10d per lb. in this country, with fine hard Para quoted at 3s 5½d per lb. The results of the chemical examination are very satisfactory, the percentages of resin and proteids being low. The rubber would be improved in quality if the "biscuits" were made thinner and were more thoroughly dried.

RUBBER OF THE "MARODI" VINE.

The specimen was labelled "Rubber from 'Marodi.' A H Unwin, No. 269"; and weighed 5¾ oz. It was a thick, rough biscuit of brown rubber, about 6 inches in diameter, and from ⅜ to ½ inch thick. The rubber was dry, well prepared, and exhibited very satisfactory physical properties. A chemical examination furnished the following results :—

Percentage of		Rubber as received.	Composition of dry rubber.
Moisture	..	2·4	—
Caoutchouc	..	78·8	80·8
Resin	..	5·2	5·3
Proteids	..	9·3	9·5
Insoluble matter	..	4·3	4·4
Ash	..	0·63	0·69

The sample was valued at 2s 6d per lb. in this country, with fine hard Para from South America quoted at 3s 1d per lb.

This "Marodi" rubber is of very fair quality, and consignments of similar character would be readily saleable. The percentage of proteids is rather high, and the amount of caoutchouc is correspondingly reduced.

The Forest Officer stated that botanical specimens of the "Marodi" vine had been forwarded to Kew for determination, but it appears that they arrived in such bad condition that identification was impossible.

RUBBER FROM THE GAMBIA.

OF *Ficus Vogelii.*

The results of a previous examination at the Imperial Institute of a sample of the rubber of *Ficus Vogelii*, Miq., from the Gambia, showed that the product was of resinous nature, but that it might be suitable for certain technical purposes. Larger specimens were, therefore, requested in order that manufacturing trials might be made, and as a result the samples dealt with in this report were forwarded for further examination.

Description of Samples.

No. 1. From the Kommbo district. Weight, 81 lb.—The sample consisted of two large balls of pale brown scrap rubber, which contained a fair amount of vegetable impurity. The rubber was slightly moist in places and obviously very resinous; its elasticity and tenacity were poor.

No. 2. From the Bathurst district. Weight, 18 lb.—This consisted of a number of thick cakes of rubber, which were very dark externally, but slightly moist and reddish-brown within. The rubber obviously contained a large amount of resin and exhibited poor elasticity and tenacity.

Results of Examination.

The results of the chemical examination of the rubbers aro given on tho following table :—

Percentage of		Samples as received. No. 1.	No. 2.	Composition of dry rubber. No. 1.	No. 2
Moisture	...	4·4	7·3	—	—
Caoutchouc	...	58·0	61·2	60·6	65·9
Resin	..	33·8	29·5	35·4	31·8
Proteids	..	1·4	1·2	1·5	1·4
Insoluble matter	..	2·4	0·8	2·5	0·9
Ash	...	0·5	1.3	0·6	1·4

It will be seen from these figures that the two specimens are similar in composition, but No. 2 is slightly superior in quality to No. 1.

Technical Trials.

The two samples of rubber were submitted to rubber manufacturers for technical trial and commercial valuation, with the following results:—

One firm reported that after a careful examination they found that the rubber from the Bathurst district (No. 2) is somewhat better than that from the Kommbo district (No. 1). The loss on washing was 6·2 per cent. in the case of the former, and 7·1 per cent. in the latter. They valued the washed rubber from No. 2 at 1s 11d per lb, and that from No. 1 at 1s 7d per lb, with fine hard Para rubber quoted at 2s 9d per lb (Nov. 1908).

A firm of cable manufacturers reported that this rubber could not be employed for their purposes, but might be useful in other branches of the industry. They stated that the rubber is very sticky in working and possesses very little elasticity or resilience; the stickiness, moreover, increases as the rubber is worked.

Conclusions.

These two samples of *Ficus Vogelii* rubber correspond fairly closely in composition with the previous specimen forwarded from the Gambia to the Imperial Institute. It is evident that the rubber is of very resinous character, the three samples examined containing 29·9, 35·4 and 31·8 per cent, respectively, of this constituent, but the results of the manufacturers' trials show that the product could be utilised for certain technical purposes, and that if well prepared it will realise a very fair price in the market. The tree, therefore, appears to deserve attention in those countries where it is sufficiently abundant to furnish commercial supplies of rubber.—*Imperial Institute Bulletin*, No. 3., 1909.

FUTURE RUBBER SUPPLY.

PROBABLE WORLD'S PRODUCTION IN 1915.

Malacca Plantations' report Criticised by Mr Stanley Arden.

The report of the directors of the Malacca Rubber Plantations Ltd., submitted to the third annual meeting of the shareholders on the 26th November and adopted unanimously, should provide food for reflection for those interested in the probable supply of rubber in the not ar distant future.

In this report the directors inform us, that "the time has now arrived when they feel justified in passing on to the shareholders the carefully prepared estimates of future yield made by the local management."

These "carefully prepared estimates" allow for a production of 750,000 lb. in 1910, increasing steadily to 7,500,000 lb. in the year 1915: as there are, according to the report 2,750,000 trees planted on 15,000 acres, this is equivalent to an *average* yield of 2·72 lb per tree or 500 lb. per acre.

It is not my intention to criticise these estimates; but, on the assumption that they are fair and reasonable, to follow the lead which the Malacca directors have given us and to endeavour to deduce from them an approximate estimate of the supply of plantation rubber, say 5-6 years hence.

The average age of the trees on the Malacca Rubber Co.'s estates works out at 2·83 years, but owing to lack of data I am unfortunately unable to state definitely the average age of the whole of the 573,138 acres under cultivation, though from the data at my disposal, I should put it at just under 3 years at the time of writing. However, as we are not dealing with anything planted during the current year, I think we are certainly justified in assuming that the average age and the average yield of the area under cultivation will compare favourably with that of the Malacca Rubber Co. estates; and it will probably come as a surprise to some to find that on the basis allowed by the directors of this Company—viz. 500 lb. per acre—the production of plantation rubber from Southern Asia alone will amount to

NO LESS THAN 127,932 TONS IN THE YEAR 1915.

At one-third the present price this would be worth £38,379,600 sterling.

I offer no comment upon these figures beyond stating that although acquainted with the majority of rubber estates in the Malay Peninsula and Sumatra, I have yet to learn that the Malacca Co.'s estates enjoy any special advantages in the matter of soil, climate, labour supply, transport, or immunity from plant diseases and pests; so, allowing that the condition of these estates is neither better nor worse than that of the average rubber plantation, and that the estimates of the management are approximately correct, we are confronted with an estimated *world's* output of just under 200,000 tons in the year 1915, assuming the yield from present sources remains stationary at about 70,000 tons.

The estimated output for the whole of Southern Asia has been put by various authorities at from 25,000—35,000 tons by the year 1914 or 1915: occassionally someone has had the temerity to suggest that the probable output will be much more, but even the estimate of 35,000 tons has been questioned by those who should be in a position to form their own opinion. Let us, however, look stern facts in the face, and see how the production works out on the basis allowed by the Directors of the Malacca Rubber estates.

We find in the annual report of the director of Agriculture, F.M.S., for 1905, that there were 241,138 acres planted in the Malay Peninsula by December, 1908; while the Ceylon Directory gives the area under rubber in that Island as 184,000 acres in June 1909—say 182,000 acres by December, 1908 as only 4,000 acres were planted during the year ending June, 1909. It is not possible to obtain accurate figures of the area planted with rubber in other countries, but Sumatra, Java, Borneo, India, Burmah and New Guinea propably account for at least another 150,000 acres. As we are dealing with Asia, we will not take into account Africa and tropical America, although planting is proceeding on a large scale in both countries. Excluding these countries, then, we have a total of 573,138 acres planted by December 1908, an average which has probably been increased to considerably over 600,000

acres during the current year. For the purpose of this estimate, however, we will confine ourselves to the area planted prior to Dec. 31, 1908.

Amid the glamour of record prices and huge dividends, it is somewhat difficult to see things in their true perspective; but even if we halve these estimates, it is obvious that the days of competition between the wild and the cultivated product are not very far distant. There is undoubtedly a period of severe depression ahead, and it is equally certain that as a result, the wild rubber industry must go to the wall, for it is inconceivable that, with the exceptionally favourable conditions obtaining in the plantation rubber industry, the wild product can possibly withstand the competition for any length of time. It follows, therefore, that rubber planting companies already firmly established have little cause for anxiety, though I am afraid the same cannot be said of some recent flotations, many of which although highly capitalised are not over-burdened with working capital: and herein lies the danger, for the bogey of overproduction will loom very large ahead, when serious competition with the wild product results in a very small margin of profit, and the working capital of the younger estates has reached vanishing point.

STANLEY ARDEN, F. L. S.

—*Straits Times*, Dec. 4.

THE RUBBER CONFERENCE AT MANAOS:

PLEA FOR THE REPRESENTATION OF THE STRAITS AND F.M.S.

It has been represented, and we agree entirely with the representation, that the forthcoming international Rubber Conference to be held at Manaos, the great Amazon seat of Brazilian rubber export should demand on the part of the Straits and F M S Governments, the closest possible attention. The great riverine valley of the Amazon, with its numerous tributaries, forms that largest area for the collection of wild rubber at present being worked. It has been announced that, with an eye to some possible shortage in the output of natural rubber, the position of Brazil as the premier exporting rubber region should be maintained by a large recourse to rubber planting in the lower reaches of the Amazon, particularly in the Para district. That rubber planting to be fostered and promoted by the Brazilian Government with all the energy and financial support it can bestow. It is easy to see that the proceedings at the Conference and the possible action of the Brazilian Government are matters which must have a very direct concern for the rubber-planting industry of the Malay Peninsula. That industry is practically monopolising the attention and absorbing the bulk of the resources of the planting communities in the several States. To develop that industry something like ten millions sterling have already been invested in the Malay Peninsula, and the stream of capital continues to flow. The prosperity of the Native States, as time goes on, must come more and more to be associated with the extension of rubber cultivation apart from the revenue derived from mining. This fact, with all the underlying financial and economic considerations, must be held to induce the Governments concerned to take what steps may seem proper in order to acquaint themselves with the lines to be adopted for the systematic promotion of rubber-planting in Brazil, and to ascertain the general purport of the proceedings at the Manaos Conference. The suggestion we allude to is that the planting industry of the Malay Peninsula, as well as the Straits and F.M.S. Governments, should be represented at Manaos by highly qualified delegates, who should watch the proceedings of the Conference, enquire, and report. It seems to us that the matter is one on which the Planters' Association might well take the initiative, for it may be taken for granted that so sensible and practical a course as that implied by the sending of one or two qualified representatives to the Manaos Conference would at once commend itself to the approval of the Governments. . . . It might be prudent, although there is no imminence, for Malayan rubber planters to make quite sure what Brazil is going to do in extending its system of working natural rubber and, more particularly, in the extension of Government supported extension of plantation rubber on the lower Amazon between Manaos and Para. But the scientific interest attaching to the Manaos Rubber Conference would of itself alone justify the Governments and planters of the Malay Peninsula taking steps to inform themselves of what takes place there, for, whatever that be, it is bound to have a very direct concern for the planting industry in this part of the world. —*S. F. Press*, Dec. 3.

'VAHEA' RUBBER FROM SEYCHELLES

Two specimens of rubber derived from a species of Landolphia (Vahea) have been examined at the Imperial Institute. The plant, which is a vine, was introduced into Seychelles from Madagascar, and is stated to grow luxuriantly, but the cost of preparing the rubber in a clean form is practically prohibitive. The results of the investigation will, however, be of interest.

"No. 1. Vahea rubber obtained by pounding the bark." Weight, 12 oz. An irregularly-shaped piece of dark-brown rubber, resembling scrap rubber in appearance, and containing a considerable quantity of bark. The rubber exhibited good elasticity and tenacity. The results of the chemical examination were as follows:—

Percentage of	Rubber as received.	Composition of dry rubber.
Moisture ..	2·2	—
Caoutchouc ..	81·7	83·5
Resin ..	5·2	5·3
Proteids ..	1·8	1·8
Insoluble matter ..	9·1	9·4
Ash	1·1	1·1

The value of the rubber was given as probably about 3s per lb. in London, with fine hard Para quoted at 4s 7d per lb. This rubber is of good quality, the only defect being the large amount of vegetable impurity present in it owing to the method of preparation.

"No. 2. Vahea rubber obtained by tapping." Weight, 1 oz. A small biscuit of clean brown rubber, the physical properties of which were very satisfactory. The composition of the rubber was as follows :—

Percentage of	Rubber as received.	Composition of dry rubber
Moisture ..	3·2	—
Caoutchouc ..	88·0	90·9
Resin ..	7·7	7·9
Proteids ..	0·8	0·8
Insoluble matter ..	0·3	0·4
Ash ..	0·3	0·3

The specimen was valued at about 4s to 4s 3d per lb. in London, with fine hard Para quoted at 4s 7d per lb. The rubber prepared in this form is of much better quality than No. 1, owing to the absence of vegetable impurities, and would realise a higher price. The results of the analysis are very satisfactory, but it is noteworthy that the percentage of resin is considerably higher than in No. 1.—*Bulletin of the Imperial Institute, No. 3, 1909.*

BRAZIL GOVERNMENT AND THE RUBBER INDUSTRY.

The Brazilian Government is waking up to the fact that the rubber industry of the State needs stimulating. In an article on "The Rubber Problem in Brazil," the "Economist" says that with the tapping on a larger scale and increased consumption it is feared the normal supplies will soon not be sufficient to meet requirements. After pointing out the wasteful way collection is made in the forests and the excessive cost owing to the remoteness and difficulties of transport, our contemporary says that the Governor of Para has sent a message to the State Assembly, urging merchants to take more care in the extraction and curing of the latex, but especially bids them to cultivate trees in more accessible districts and thus compete with the plantation companies. The "Economist" further adds that to combat the various existing abuses the State Government is proposing to regulate the tapping of trees, fixing the time when the first incision may be made and its height above ground. Whilst recognising that these regulations will be difficult to enforce, our contemporary thinks it imperative that this Government inspection should be started without delay, and concludes that "everything goes to show that the Brazilian rubber industry is approaching a critical point in its career; for unless it is placed in a position to compete with the more modern and scientific methods of culture adopted in other parts of the world it must inevitably lose its present predominant position." To which may be added that, seeing that rubber is the greatest revenue producer Brazil possesses, with the exception of coffee, it appears suicidal not to prevent the industry going to the dogs.—*H. & C. Mail*, Nov. 26.

RUBBER IN BRITISH GUIANA.

It is reported from British Guiana that rubber planting is being conducted with enthusiasm. The supply of hevea (rubber) seedlings at the Botanic Gardens is already nearly exhausted, but a large quantity is expected to arrive from the Straits Settlements next month.—*H. & C. Mail*, Nov. 12.

A NEW AUSTRIAN RUBBER PLANT.

Planters who have been asking for some plant which would give them an annual crop of rubber in the interval between planting and tapping their Para rubber trees, will read the account of a recent discovery in Austria with interest. It appears that Lactuca viminea, a biennial plant of the order Compositæ, found in Austria, yields a latex which contains an amount of rubber corresponding to about 0·5 per cent of pure caoutchouc on the weight of the dry substance of the plant. It thus yields, says an enthusiastic correspondent, more rubber than *Hevea brasiliensis*, from which—according to Alexander and Bing—only about ·3 per cent is obtainable. The writer, however, does not point out, as he should if unbiased, that Para rubber trees are not felled and macerated, but are tapped every alternate day throughout the greater part of the year and allowed to live for twenty or more years under such treatment. For the determination of the caoutchouc content of L. viminea, the plant, at the period of its maximum growth, was dried, extracted with petroleum ether, the extract treated with 10 per cent alcoholic caustic potash to remove saponifiable matter, and then extracted with carbon bisulphide. From the evaporation residue of the carbon bisulphide extract, the resin is removed by means of acetone, and then the pure caoutchouc determined by Harries and Weber's method, and Fendler and Kuhn's modification of Budde's method.-*I.R. Journal*, Nov. 15.

RUBBER IN CEYLON.

A South Indian Visitor's Impressions.

At the Peradeniya Experimental Station, I saw the Dichotoma rubber growing. Some of this had been brought under tapping and if the result (details of it are in the current *Tropical Agriculturist*) is disappointing, it must be remembered that they are very young. Ceara there is being tapped like Para and the results from those trees that will yield is considered satisfactory. Although this is so, I gather from what I heard (I am not an eye-witness) that Mr Westland's method is the better. It would be advisable for those who have Ceara trees to cherish them; they are worth more standing, than as fence posts or firewood. No doubt in time seed will be available from a strain of well-known latex givers.—*Madras Times*, Dec. 9.

"CASTILLOA" RUBBER BY THE CENTRIFUGAL PROCESS.

The rubber delivered by the Lesher centrifugal machine, now in use on La Zacualpa plantation, in Mexico, is in the form of biscuits, which would readily be taken for typical fine para bis cuits. When one of them is cut in two, it shows a very densely coagulated light-coloured surface with a suggestion of thin layers, such as are produced by the smoking process. The rubber is very clean and tough, and the outside surface, where it is exposed to the air, has a mahogany colour instead of the black that *Castilloa* so often acquires.—*India Rubber World*, Oct. 1.

THE SOY BEAN.

Cultivation and Utilisation.

During the present year an important commercial development has taken place between this country and Manchuria with reference to the soy bean, the seed of *Glycine Soja* (*Soja hispida*). The soy bean is a leguminous plant which grows abundantly in China and especially in Manchuria, where the seeds form an important article of diet and are highly appreciated on account of their valuable nutritive properties. The occupation of North Manchuria by Russian troops during the Russo-Japanese war created a large demand for provisions, whereby agriculture was stimulated and considerable expansion took place. After the close of the war and the withdrawal of the troops, the local demand naturally declined and it became necessary to find an outlet for the crops in foreign markets. From 1906 to 1908, much of the staple produce of North Manchuria was exported to Japan through Vladivostock, but in 1908 the trade suffered owing to the depression in Japan, and towards the end of that year beans and wheat began to be exported on a large scale to Europe. Enormous quantities of soy beans are now being imported into the United Kingdom and the Continent.

The first large cargo of soy beans consigned to the United Kingdom arrived in Hull on the 2nd March, 1909, and amounted to 5,200 tons. It is stated that before June contracts had been made for the delivery of no less than 200,000 tons. The beans are said to arrive at their destination in perfect condition in spite of the great distance they have to be carried. They are classified into three grades: No. 1, shipped at Dalny; No. 2, shipped at Vladivostock; and No. 3, shipped at Hankow. The value of grade No. 1 is about £6 8s per ton gross, c.i.f. European port direct, whilst the values of Nos. 2 and 3 are equal and about £6 6s per ton gross, these prices being, of course, subject to the fluctuations of the market. The greater part, if not the whole, of the soy beans imported into this country is purchased by the proprietors of oil-mills, who crush the product and thus obtain a quantity of oil, amounting to about 10 per cent by weight of the seed, and a residual oil-cake which has proved to be a valuable cattle-food.

Cultivation.

The soy bean grows most satisfactorily on soils of medium texture containing fair quantities of potash, lime and phosphoric acid. It is said that good results have been obtained on comparatively light soils and that an abundant crop is sometimes produced on land too poor for clover. In South Carolina, good results have been obtained on sandy, limestone or marly soils, and also on drained swamp or peaty lands. If the soil is lacking in potash or phosphoric acid, these constituents should be supplied in the form of artificial manure. It is not necessary to apply nitrogenous manures, since the soy bean, like other leguminous crops, has the property of extracting nitrogen from the air and thus enriching the soil in which it is grown. With regard to climate, the soy bean requires about the same temperature as maize. The plant is very resistant to drought, can endure slight frosts, and is capable of withstanding excess of moisture; in this last respect, it is said to surpass cowpeas or even maize. The cultivation of the soy bean is carried out in much the same way as that of ordinary field beans. The soil should be well tilled and left smooth and free from clods. The seed is best sown in drills from two to three feet apart, the exact distance depending on the texture of the soil. The amount of seed required is about one-half to three-quarters of a bushel per acre, enough being sown to give on the average five or six plants per foot in the row. After sowing, the the land must be kept fairly free from weeds and the surface soil must be occasionally broken up. The pods are usually harvested before they are quite ripe, as otherwise they are liable to burst on drying, a loss of seed being thus occasioned. The plants may be pulled by hand or cut with a scythe; they are collected into small heaps in order to facilitate drying. When dry, the seed can be readily separated by means of an ordinary threshing machine.

Under ordinary circumstances, a yield of 22 to 40 bushels per acre is obtained, but under specially favourable circumstances the crop may be considerably larger.

Glycine Soja is not only of value to cultivators for the sake of its seeds, but it can also be grown for green forage, for ensilage, for hay or as a pasture plant. Reference has already been made to the special value the plant possesses due to its ability to restore impoverished soil by affording it a supply of nitrogen. It has been found that the earlier varieties are best for seed crops and the later varieties for hay, forage and ensilage.

Composition of the Seeds.

Although there are several varieties of the soy bean, differing in the size, shape and colour of the seeds, there does not appear to be any definite and constant difference in the chemical composition of the latter. The following analyses indicate the usual composition of fresh or airy-dry soy beans. No. 1 gives the results obtained by Professor A H Church with a sample of the beans grown in India. The figures recorded under No. 2, also quoted by Professor Church, were deduced by Dr. Forbes Watson from eight analyses of unhusked soy beans, four of the samples being of Chinese origin, and from two analyses of the husked beans. The results under No. 3 are the averages obtained with several different varieties of soy bean grown in the United States of America, and are taken from the *Farmers' Bulletin*, to which reference has already been made.

Percentage of	No. 1	No. 2 With husk.	No. 2 Husked.	No. 3
Water ..	11·0	9·1	10·3	10·8
Albuminoids ..	35·3	40·4	43·6	34·0
Carbohydrates ..	26·0	25·1	21·0	28·9
Fat ..	18·9	15·8	15·5	16·9
Fibre ..	4·2	5·2	4·4	4·8
Ash ..	4·6	4·4	5·2	4·7

The value of the beans as a food is evident from the large amounts of albuminoids and fat they contain. It has been stated by Japanese authorities that the product does not contain any sugar or starch, and for this reason the bean has been as a basis for foods recommended for persons suffering from diabetes.

Utilisation of the Seeds.

In the United Kingdom, as stated previously, the seeds are mainly employed as a source of oil, an oil-cake being obtained as a by-product.

The oil possesses an agreeable taste and odour, and is largely used by the Chinese for edible purposes. It belongs to the class of semi-drying oils; that is to say, it has properties intermediate between those of the drying oils, such as linseed oil, and the non-drying oils such as almond and olive oils. On exposure to the air, a thin skin is gradually formed on the surface. It resembles cotton-seed oil in many respects, but is of a more pronounced drying character, as is indicated by its higher iodine value. The oil consists mainly of the glycerides of palmitic, oleic and linolic acids. The physical and chemical constants, which have been recorded for soy-bean oil are given below, the corresponding figures for cotton-seed oil being added for comparison.

	Soy-bean oil.		Cotton-seed oil.	
Specific gravity at 15° C.	0·9240—	0·9270	0·9220—	0·9260
Saponification value	190·6	—192 9	191·0	—196·5
Iodine value	121·3	—124·0	101	—116
Hehner value	95·5		95·9	—96·2

The oil is chiefly used in this country for the manufacture of soap, and is very well suited for this purpose. It is quoted in the London market at £21 5s per ton (September, 1909), with crude cotton-seed oil at £23 to £23 5s per ton.

The oil-cake left after the expression of the oil is hard and heavy, and resembles linseed cake, but is lighter in colour, and has a characteristic taste recalling that of peas. The nutritive value of this product is approximately equal to that of decorticated cotton-seed cake. The average composition is as follows:—Albuminoids, 41 per cent; oil, 6 per cent; carbohydrates, 30 per cent; moisture, 12 per cent; fibre, 5 per cent; mineral constituents, 6 per cent.

Feeding Trials with this Cake in Comparison with Decorticated Cotton Cake

have been carried out at the Cumberland and Westmoreland Farm School at Newton Rigg, and also at the Royal Agricultural College, Cirencester. At the former institution it was found that the cows, when fed with soy-bean cake, gave rather more milk than when fed with cotton cake; but the difference was so small that it may be considered that the two cakes are equal in this respect. The proportion of fat in the milk was the same in each case. During the trial the cows gained in weight, the soy-bean cake causing a slightly larger increase than the cotton cake. The soy-bean cake used in these experiments contained 6·0 per cent of oil and 44·4 per cent of albuminoids, whilst the cotton cake contained 13·1 per cent of oil and 39·9 per cent of albuminoids.

The experiment at Cirencester showed that the yield of milk was but little affected by the kind of cake used. The percentage of fat in the milk was slightly higher with the soy-bean cake than with the cotton cake. The butter produced from the milk of the cows fed with soy-bean cake was quickly obtained on churning, but was softer, and of a paler colour and somewhat inferior flavour to that from the milk produced by the cows fed with cotton cake. The soy-bean cake used in these trials contained 6 per cent of oil and 40 per cent of albuminoids, and cost £6 10s. per ton, whilst the decorticated cotton cake contained 8 per cent of oil and 34 per cent of albuminoids, and cost £7 10s. per ton.

In the experiments at Cirencester no difference was observed in the effect of the two cakes on the cows with regard to their laxative or constipative action. It may be mentioned, however, that certain cases have recently been brought to the notice of the Imperial Institute in which it was stated that the soy-bean cake when fed to cows produced a "scouring" or laxative effect. It seems not unlikely, however, that these symptoms may have been caused by the use of an ill-proportioned diet. Owing to its excessive richness in albuminoids, soy-bean cake should be used with the same precautions as are observed in the case of decorticated cotton cake, which is said to be unsuited to calves and lambs, and when used for adult stock should be mixed with about an equal weight of some cereal product, such as maize, barley meal, wheat meal, or American flour.

In view of the importance of the trade in soy beans, it has been considered desirable that attempts should be made to grow the product in other countries than China. The Imperial Institute has already brought the matter to the notice of the Governments of several British Dependencies, and experiments are now in progress in the Cape of Good Hope, Natal, the East Africa Protectorate and the Gambia. An effort is also being made to stimulate the cultivation of the soy bean in India.

It is stated that considerable additional areas are avilable for cultivation in Manchuria.—*Bulletin of the Imperial Institute*, No. 3, 1909.

PARA RUBBER SEED MAY-JUNE CROPS: A QUERY.

In reply to the Indian Forest Officer who writes below, we may say, on authority, that the rubber seed crop obtainable here in May or June is very small. Our correspondent would probably be safely able to procure 5,000 seed then, though not large supplies; such earlier seed, we understand, would be quite as reliable as any borne in July.

Gersapa, Kanara, Dec. 5th, 1909.

Sir,—On page 39 of the Supplement to the *T. A.* for August, 1907, I find the statement made that the Para tree yields seeds in the month of July every year in the lowcountry (in favourable years.) I should feel greatly obliged to you if you could get the following information for me:—"If any reliable seed of Para Rubber could be obtained *in May or June* in the coming year—say about 5,000."—Yours truly,

M. S. TUGGERSE,
Forest Officer, etc., Gersapa, Kanara.

AN EX-CEYLON PLANTER ON FIJI.

A veteran Ceylon planter, who has been at home for a holiday, sends us a letter, a little belated but none the less interesting, from an old Colonist of Ceylon who migrated early from Fiji. We make the following extracts :—

Levu, April 23.— ... Memory often calls back to me the old times when coffee was king, and bumper crops, tots of arrack and Mootoma and Meenachie moved things so merrily along; when the vestige of a weed a wrongly pruned secondary—or even tertiary—bone dust poonac and cattle manure gave the old gentleman so much concern. Tea and rubber, I suppose, now reign supreme. Tea, I believe, is now fetching a fair price. I infer that there is good acreage of rubber now fit for tapping. What with these products times ought to be bright and cheery in Ceylon now. ... What an *ignis fatuus* that Alpha coffee in its opening glory proved to be to many of us. It is somewhat flattering to myself to know there were wiser and more knowing ones than me dupes of the illusion. Short as was its career, there has not been so much individual enterprise shown or private capital spent since in so short a time in any other industry in Fiji.—The high prices ruling for

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during the last few years has led to no influx of new settlers, extension of cultivation, or improvement of existing properties worth mentioning. Although the Indian element has considerably increased since you left, the European and Fijian population has fallen off. The Indians appear to thrive well on their crime and filth—and the congenial conditions under which they are living. As regards the Fijians, the legislation—and what is termed civilisation—appears to be too much in advance of their intelligence, customs or requirements. In regard to Europeans with all the accumulation of laws and vaunted measures for the welfare of the Colony, there were more men with brains and money coming to Fiji under the old condition of things than even now. Enquiry for land is chiefly confined to Indians and a few of the old settlers anxious to augment their present restricted resources—or those of their children. Any general determination on the part of the present settlers—or real Governmental practical help or encouragement to do so—to give any fair trial to any new product brought under their notice likely to be successful—even by those who have ample means for doing so at their disposal—is almost totally totally absent. Indeed, it may truly be said, enterprise is altogether dormant—except in a very few exceptional instances. Progressing as things have been doing during the last 10 years,

THE OUTLOOK DEPICTS A COLONY OF INDIAN SHOPKEEPERS

and small Indian lease-holders with a regiment or two of soldiers to suppress disturbances. Some extension of operations on the part of the C. S. R. Co.—and well-trimmed Government reports and messages—help to gild over the actual conditions of things. Although, as you know, the Company's operations are large—excepting the Indians and a few shopkeepers—only a few others—and these in a very scanty measure—have profited by them, and it may truly be said that the planters have suffered by their monopolising influences. Blot out the Company and what remains! ——— told me three or four years ago that not 10 per cent of those engaged in cane-growing had bettered themselves, and most of these only in a small degree. Banana-growing still survives with all its fluctuating results.

COCONUT CULTIVATION

—as it now appears, the best Fiji can boast, in my mind—owes its origin rather to the perseverance and struggles of the old settlers than any other cause. A few engaged in this cultivation, such as Tarte, Coubrough, Miller, Borron, &c., who, with good luck and favoured circumstances, have been able to grasp their opportunities, are now, in their eleventh hour, deriving appreciable incomes. Whilst the smaller fry, through the absence of hurricanes prevailing for the last few years, are generally contented with their smaller share of the loaves and fishes....Unlike in former years, the Garden of Fiji now supports its dignity by the production of copra and beef alone. ... I am located on the ——— plantation belonging to Mr. ———, making what I can out of the manufacture of scents, perfumed and other soap, and perfumed—and other oils—for the local market. I am just at present making arrangements for trying to enlarge my operations and think there are some possibilities attending my plans. Mr. ——— has about

THREE ACRES OF LAND PLANTED WITH PARA RUBBER.

The plants are now about 13 months old. They were raised from stumps obtained from Williams, Ceylon. The stumps were somewhat small with a paucity of lateral roots and spongioles —as if they had been cramped and stunted. Holes (18") were dug for them on new land. A little shade at time of planting, and a few months following was employed. The stumps were planted 15 by 15—with Fiji kava and tobacco as a catch crop. They encountered a mild blow in March, but, being staked, did not apparently, suffer any injury. The plants are somewhat irregular in size and growth, owing, I think, to the irregularity of the size of the stumps used for planting. The best of them are now about 10 feet high and 2¾ inches in girth 3 feet high from the ground. It is proposed they shall be topped at 12 feet. What do you think about the growth they have attained—and prospect of the cultivation in Fiji?

You will remember how strongly you advised me many years ago to plant rubber in Fiji. I am now sometimes inclined to think I should have considered the matter more seriously. Had I done so my fortune might perhaps have been changed. The great difficulty has been the scarcity and dearness of the seed. I suppose this is now disappearing. As I have been partly instrumental in ——— making the experiment, and am watching it with much interest, any suggestions or wrinkles you can offer me in regard to the cultivation or best and cheapest way of procuring seed will be much valued.

RUBBER ON THE GOLD COAST.

[BY A RECENT VISITOR TO PERADENIYA.]

The rubber at present exported from the Gold Coast is the product of several latices, the most important of which is that of the

FUNTUMIA ELASTICA.

The jungle vine (Landolphia owariensis) also furnishes a good deal of ball rubber. The quality of most varieties of Gold Coast Rubber is poor, owing to the sticky, resinous, unattractive mass which it presents. This is mainly due to two causes :—(1) the native ignorance of improved methods of preparation ; and (2) their habit of collecting and mixing every latex having a white milky appearance, in the belief that they profit by having for sale a greater quantity of so-called rubber. Much attention has been drawn to this product of late and to the wasteful system of tapping which has been going on. The Department has done much good work in demonstrating various improved methods in the manufacture of rubber and in afforestation, several million plants and seeds having been raised and distributed from the Agricultural Stations for planting in the forest areas. The system of tapping practised by the uninstructed natives is very wasteful, and the trees, where they have not been killed, have been very much disfigured by excretionary growths due to injury to the cambium, which renders a second, or repeated, tapping in subsequent years, well-nigh impossible.

It has now been clearly demonstrated that rubber of very fine quality, second only to the very finest Para, can be made from the latex of Funtumia elastica ; moreover it would appear that the trees reach maturity, when favourably planted, almost as soon as the Para variety. It is true also that the older the trees, the better will be the quality and greater the quantity of rubber produced as in the case of Para ; and it is somewhat reassuring to know that trees of this species can be replaced in such comparatively short time from seed.

The chiefs have of late been interesting themselves very much in the work of the Agricultural Department, and if we are able to get their hearty co-operation, as well as that of their followers, it should be possible to effect a marked improvement in the quality of this product in the course of a few years, and a considerable increase also in the quantity exported.

The trees of this species on the Agricultural Stations have not yet proved altogether satisfactory rubber yielders ; but it is possible that the best method of growing the trees has not yet been ascertained, and I propose to institute experiments in this connection. No exhaustive experiments, however, have yet been made to ascertain the exact amount of rubber yielded per tree, and this is a subject worth careful investigation (see previous reports of this Department.) "Funtumia" offers one considerable advantage over "Para," *i.e.* a greater quantity of latex can be extracted in a single tapping, and for this reason it is perhaps better suited to native methods.

KREPI BALL OR "PEMPENE" RUBBER.

The jungle vine, Landolphia owariensis, from which the ball rubber of commerce is mostly obtained, appears to be of slow growth. Experiments made at the Agricultural Station indicate that a long time must elapse after planting before it can be tapped.

In any case, this is not a species that could be cultivated in the ordinary sense of the world ; it is purely a jungle plant and climber ; but when found in the open country, it seems to develop a tuberous, rubber-yielding root, specimens of which have been collected in the Northern Territories and identified at Kew.

MEMLEKU RUBBER.

Another indigenous rubber tree worth mentioning is the Ficus vogelii, which in certain parts of the Colony, notably the Krobo-Afram country, is fairly abundant.

The rubber obtained from this species is of a very poor quality owing to the large percentage of resin it contains, but as each tree yields a large quantity of latex this rubber is possibly worth more attention. In continuation of previous tests I hope to send a large sample of this product to the Imperial Institute for commercial tests. The previous valuations of it were from 2s. to 3s. 6d. per lb. ; but even at these prices it was not certain whether a market could be established in this article. (See Annual Report for 1907.)

The Product is more after the nature of Balata and I presume that if a market could be established it would be used for somewhat similar purposes. A small area was planted with this rubber tree at Aburi Botanical Gardens from cuttings, and it is evident there is more than one variety of Ficus yielding this rubber, but a close examination has not yet been made.

PARA RUBBER.

Amongst the many other introduced products that promise fairly well is that of Para rubber, (Hevea brasiliensis.) A few trees were first introduced at Aburi in 1893 and rubber was extracted from them in 1903. Small plantations were formed at the Aburi and Tarkwa Agricultural Stations in 1900-1 and 1904 respectively. At Tarkwa the trees were planted at experimental distances, particulars of which will be found recorded under the notes on the station in this report. They have not yet been tapped, but the rate of growth is very satisfactory and compares favourably with that of the same species in the Federated Malay States and Ceylon, where it is now being cultivated on an extensive scale.

In the East, when a tree has attained a circumference of 18 inches to 20 inches at 3 feet from the ground, it is considered tappable. This is not usually reached before the sixth year after planting, so an average of 17 inches for every tree 4½ years old on the plantation at Tarkwa shows great promise for the species in the Gold Coast.

At Aburi the small plantation of 154 trees, planted at 15 × 15 ft. in 1900 and 1901, shows an average circumference of 20½ inches at 3 ft. from the ground which is also very gratifying, as the soil here is more dry and stony and not therefore what is usually considered quite suitable for Para rubber.

I had a small experiment conducted in the latter part of the year with a view to determining the quantity and quality of rubber these trees are likely to yield. Ono row through the plantation containing 15 trees was selected, one of which was considered too small to tap; but the results, as representing the produce of the plantation, have been calculated on the total. They were tapped on the half-spiral system and 3 times a week, the period extending from 19th November to 31st December. The latex was coagulated with the addition of a little acetic acid and the rubber prepared in biscuit form. 2 lb. 8½ oz. of dry rubber were obtained, this being equivalent to 32½ lb. per acre. Assuming that the trees are given a rest of three months every year, this works out at 206 lb. per acre per annum. The rubber is of good quality and the result, considering the age of the trees, the nature of the soil on which they are grown, and the season of tapping (which was just previous to the wintering of the trees) may be considered very satisfactory.

It is evident that this rubber tree will grow and yield well on the Gold Coast, and as our trees are now seeding freely, I anticipate a somewhat extensive multiplication within the next few years. The natives who have already planted it seem very pleased with its rate of growth, and are asking for more plants. As a native cultivation it should be very profitable for it can be carried on in conjunction with cocoa, amongst which it may be either planted as shade or set in belts round the plantation; but it is not likely to succeed well if planted under jungle shade.

Ceara and Castilloa Rubber.

Ceara (Manihot Glaziovii) and Castilloa (Castilloa elastica), two other varieties of rubber trees, have been introduced, but neither of them are at all promising. The former succeeds best in the dry zone and it is just possible that it may grow more satisfactorily in the Northern Territories, where, on the establishment of a station next year it will be given a trial. The Castilloa would not appear to be at all suited to this coast, for, besides showing only a very indifferent growth, the trees are badly attacked by a longicorn beetle which practically destroys them.—*Official Report for 1908* of W. S. Tudhope, Director of Agriculture, Gold Coast.

NEW LEGUME FOR RUBBER.

[To the Editor, "Malay Mail."]

Sir,—I shall feel greatly obliged if you will kindly publish the following in your esteemed columns. Mr. J. B. Carruthers, Director of Agriculture and Government Botanist, Federated Malay States, in his report for 1908 on cover plants, sums up his *ideal* plant as follows:—

"The ideal plant for the purpose of protecting rubber land and eliminating or reducing very considerably the weeding bill is a plant which grows not more than a foot to 18" high, is permanent for 3 or four years, producing shade over the ground, growing so luxuriantly as to exclude weeds, without forming a thick turf, is leguminous, has no thorns or spikes to interfere with coolies working, has no leaves, fruit or flower which will attract vermin or other animals. None of the plants at present in use or being tried in the experimental plots of the Agricultural Department fulfil absolutely all these requirements, and it is probable that plant will yet be found, better than any yet at present tried."

He then mentions a number of cover plants, but none of them come up to his ideal. I therefore presume the "cassia mimosoides" is a strangor to him, as he does not mention it, and funnily enough it's a legume that comes as close to his ideal as I fancy will ever be found. To enumerate—it's a *flat* spreading leguminous plant, *absolutely* thornless, *sensitive* in so far that it closes its leaves at night and during rain, opens directly the sun shines and thus conserves moisture, grows thick to the exclusion of weeds is in *no* way turfy, does not attract vermin as far as my experience goes (I vouch for this as this district is rich in vermin of sorts), grows quickly, is a particularly free seeder, and if not a permanent cover will certainly resow itself so continually that the ground will never be clear of it unless desired to be forked in as a mulch. Another advantage: it saves *wash* during heavy rain.

The plant grows well at *all* elevations. Its height will, I am sure, never exceed 18" at the lowest altitude and from 4,000 to 6,000 feet above sea level it grows practically *flat*. There is no doubt that it will as a cover plant rich in nitrogen suit *all* products. I do not know Mr Carruthers' address, but if he or any planter interested in the subject wishes for any further information I shall always be happy to reply.—I am, etc.,

Phil. Beaver.

Sholarock Estate, Katary P. O, Nilgiris, S. India. Nov. 25th, 1909.—*Malay Mail*, Dec. 11.

CAUSE OF TACKINESS IN RUBBER.

Dr. Fritz Frank, in a communication to the "Gummi Zeitung," attributes the occurrence of "tackiness" in certain raw rubbers to the presence in the rubber, as coagulated, of imperfectly polymerised portions, which owe their existence to unsatisfactory methods of coagulation. In the smoking process employed in the case of fine Para, every portion of the latex comes under the influence of the coagulating, polymerising agent, and "tackiness" is normally absent. When a mass of raw rubber containing imperfectly polymerised portions is subjected to mechanical working, the faulty portions become distributed through the mass, upon which they exercise a solvent action resulting in general deterioration. The presence of water in the raw rubber tends to check any action of this kind. It is possible that bacterial or enzyme action may play a part in the spread of tackiness, the heat generated either rendering the sound rubber more liable to attack (solution), or even bringing about a direct depolymerisation. The following precautionary measures are advocated: (1) Intimate mixing of the coagulating agent with the latex. (2) Use of only small quantities of latex at a time, in all cases where the process employed is such as to render likely the formation of lumps and consequent inclusion of uncoagulated latex. (3) Protection of the coagulated rubber from the action of light and heat. (4) Minimum mechanical treatment of the rubber at the place of origin. (5) Packing in cases, and storage in cool places during transport. (6) Presence in the raw rubber of a certain amount of moisture.—*India Rubber Journal*, Nov. 29.

RUBBER COMPANY PROMOTION IN THE F. M. S.

A Lurid Picture.

The *Penang Gazette* is very jealous of the fair name of the sister colony in the matter of Company promotion. In the course of an article in its issue of 7th December headed "a rubber warning" the following sketch appears and we are assured "there have been several flotations recently of which it represents a faithful description":—During the last twelve months we have seen a select little band of persons, who a year ago hardly knew the difference between a rubber tree and a coconut palm, desert their desks and rush wildy about the country, getting options on every little bit of a native-owned *Kebungetta* where a couple of Para seedlings peep coyly out through the "undulating lalang." Wearing an air of importance and ill-fitting khaki clothes, talking in millions and thinking in square miles, they seem to have succeeded in finding "experts" willing to furnish for a consideration the reports they require. Then it merely becomes necessary to share the spoils with "a firm in the City," get an ornamental board of guinea-pigs together, advertise and puff the flotation extensively in the London financial papers and the public—the same dear, stupid old public which rushed after John Law and Jabez Balfour—will fall over one another to obtain shares. The issue is "largely over-subscribed" and for the time being everyone is satisfied. The *towkay* has got rather more than the value of his *kebun*, the philanthropic promoter has got some hard cash and a parcel of shares which he will gradually unload on a confiding public, the directors have got their *douceurs* and their fees, and the happy shareholders have got their precious estate, which they fondly imagine to be rather better than Lanadron or Vallambrosa. It is a charming little game, but it must not be played too slowly by the promoter, whose motto should be "the more, the merrier" as his object is to "make hay while the sun shines."

MONTHLY PUBLICATION OF RUPEE RUBBER CO. CROPS.

Dec. 5th.

Dear Sir,—As you are well aware, on the morning of the 2nd of each month, the London financial papers begin publishing the cabled reports of rubber crop harvested by Straits Companies during the previous month and by the 4th or 5th all the returns have appeared.

When one endeavours to praise Rupee Companies at home, the chief reason given by would-be investors for not taking shares in these is (after mentioning the slight inconvenience of changing Sterling into Rupees) the difficulty in getting information about the doings of these Companies.

"Why"—did a man tell me—"should I go in for these concerns when the antiquated policy of keeping as long as possible all information for the Directors, the Agents and their favoured friends is still tolerated by local investors."

The Seremban Co.—now a Sterling one—is about the only Company to send you its monthly crop; but why on earth should not large producing Companes like Jebong, Beverlac, Grand Central and all the Teas and Teas-cum-Rubber Companies send you monthly a short statement of their results?

No long sentences. Simply. . . . . Co. November, so many lbs. Total to date. . . . To same date last year. . . . .

I am sure you would willingly publish just these two lines from the leading Companies and this information would in turn be taken from you by the London Financial papers for the great satisfaction of home investors.

The quarterly crop statements, with the prices obtained, could continue to be issued to shareholders four times a year.

I mean to attend all the coming meetings of Companies I have shares in and will propose that such a course be followed; but shall I get any support?—Yours sincerely,

L. B. W.

PERCENTAGE OF SCRAP TO FINE PLANTATION RUBBER.

We call attention to the further letter of "C. W. H." below, and would like to hear from some of our leading rubber planters, what their average percentage of scrap rubber is to their total crop, and by what rules or methods they reduce or limit it.

I.

Colombo, Dec. 12th.

Dear Sir,—My letters to you on the subject of "Percentage of Scrap" do not appear to have excited the interest I hoped; at any rate the only reply they have so far provoked fell short of the precise information I desired. Yet it seems to me that the subject is not without interest, nor one that need remain clouded in mystery! I have heard it stated that on some estates Superintendents are not allowed to show *more* than a certain percentage of scrap collected as such; in others, that scrap is not considered worth the trouble of collection because of the cost when it does not *exceed* a somewhat similar percentage. One would suppose that there must be good and sufficient reasons for such variety of practice; and yet the underlying common principle, if there is any, is hard to recognise.

What is clear is, that as the price of fine rubber recedes, there will be less demand for the inferior qualities except at a price which will become less and less proportionately to the cost of collection. On the other hand greater efforts will doubtless be made to lessen wastage or deterioration of good latex at the source by more efficient methods of collection.

In those days it will be known to a nicety what percentage of latex may be expected from the collecting cups, and what may have to be brought in by manual labour.

Am I premature—or only too inquisitive—in asking those, who are able, to supply such information at the present time?—Yours faithfully,

C. W. H.

P.S.—When fine rubber is down to 2s/6d per lb. will it pay to collect scrap?—and if the scrap amounts to 40 per cent of the estate crop, what then?

II.

Dec. 11th.

DEAR SIR,—In further reply to your correspondent, "C. W. H.", who certainly appears to be "a beggar for argument," I'll remind him "Quot homines, tot sententiae." Superintendents do not all think, or act, alike; a man is right because he thinks he is. I do not know much about "underlying common principles"—only sound common practice. Isn't it obvious?—the more No. 1 rubber and the less scrap, the better, since the former fetches the better price. I was visiting a neighbouring place last week where instead of any drip-tin they use a water bottle and pour water into the tapping cuts, with excellent results. Figures are not kept, but the percentage of scrap there is, I should think, about 2 per cent. With the use of the drip-tin, it is practically nothing—there is so little scrap to collect, it does not pay to regularly collect it. If a cooly finds a little inthe cut, he just pulls it off, and brings it to the factory with him.—Yours,

H. V. A.

RUBBER-GROWING IN QUEENSLAND.

Much interest has been manifested by botanical experts in the Commonwealth of Australia in the 300 Isoandra gutta-percha trees grown at the Melbourne Botanical Gardens from seed procured in Java by Dr. Crivel. This particular species, which is unknown in Australia, produces a gutta-percha which is unequalled for several classes of work, particularly in connection with electrical fittings. The tree takes 20 years to come to maturity, but is seed-bearing before that time. Mr. Howard Newport, of the Queensland State nursery at Kamerunga, has inspected the seedlings, and found them healthy and flourishing plants. The 300 available plants will be divided equally between nurseries in the Northern Territory, in Queensland, and in Papua. It is Mr. Newport's intention to recommend the Queensland Government to retain the trees in the Kamerunga nursery as a base stock for the future supply of seeds to planters, as the importation of the stock is difficult by reason of the short vitality of the seeds. He considers the establishment of the nucleus stock will ultimately assist in creating a valuable industry in Queensland.—*Financier*, Nov. 25.

RUBBER PLANTERS IN DELI

—Sumatra—are setting their faces against the use of tin cups for collecting the tapped latex from the trees. It seems that, in the open air, these cups are attacked by rust which stains the coagulated latex in them and spoils its market value. Several planters are using aluminium cups instead to catch tho latex. This metal is not liable to rust and has the additional advantage of being cheap.—*Straits Times*, Nov. 11.

INDIA'S TEA COUNTRY.

(*The Field*, Nov. 20.)

I think the first impression made on me when I came here now nearly twenty years ago, was the denseness of the jungle growth as seen from tho river steamer. The hills along the banks of the Brahmaputra seemed like great heaps of all kinds of trees cut and piled up in stacks, rather than a natural growth, as from a very short distance no ground at all is visible. If inclined to sport, the new chum's

SPECULATION RUNS ON WHAT SORTS OF GAME

are hidden beneath all that wonderfully dense greenery, how it is to be got at, and what his luck at the shikar he has heard so much about will be. If it is the cold weather, when the river is low, he will probably take shots from the deck at the crocodiles, which are visible in their hundreds lying basking on the mud banks. These are entirely fish-eaters; for the mugger, or carnivorous and man-eating sort, is not found in Assam rivers. One can swim in perfect safety everywhere, no matter how numerous the "crocs" may be. A very general idea is that their scales aro almost impenetrable. This is quite wrong, so far as this species is concerned, at all events, for an ordinary gun will send a bullet right through them.

WHAT A PERFECT CLIMATE THE COOL SEASON IS

in Assam from November to April! There is practically no rain, and the temperature is seldom more than 75° even at midday, and is down to 45° at night. The cold weather visitor of the "Padgett, M.P.," type wonders what hardships there can be to grumble at with such a climate; but he never stays till the rains set in, and rain it does then, very consistently, when the register is 90° and higher and the atmosphere so saturated that it is that of a forcing house; then, even with no exertion, our clothes are soaked with perspiration during the whole twenty-four hours for five months on end, and there is a ceaseless hum of mosquitoes.

WHAT A FRIGHTFUL PLAGUE INSECTS ARE

in the tropics! They are worse than the heat itself. The mosquito is, of course, the worst, and is, as most people now know, most dangerous, especially the anopheles species. There are many species of mosquito, but this, I believe, is the only dangerous one. The so-called "harmless" ones are, in all conscience, unbearable enough pests, it being impossible to get any sleep without the net during the rains. Even a more painful experience is that poisonous little sandfly, no bigger than a pin's head, but an "incarnate bite," far more irritating than Mr. Skeeter. He comes in silence: is not perceived until his work is done and he departed. Skeeter, on the other hand, is a sportsman to the extent that he sings on his way to and fro, which is a mercy, though a small one. Very luckily the sandfly is not ubiquitous, like the mosquito, being peculiar to certain soils, for a net in order to keep him out would have to be so closely woven as to be impossible to sleep under. Ticks in the jungle are very bad too; one "jat" is so small as to be almost invisible. I have had these on my legs above my stockings so thick as to

look like garters, and have had to shave them off with a razor. The most loathsome, though, is one quite flat and the size of a threepenny bit. It is found on big game, and is of a dirty grey colour, and can bite through linen, and when it does so, it feels like the prick of a red-hot blunt needle. There are also many other kinds, and one I have taken off a tiger which was as big as a thrush's egg. Dog ticks seem never to attack one, though they are brought home by the score. I have noticed in skinning big game that some sorts of tick seem unable to relinquish their grip of their dead host, but remain attached to the skin until they rot off. It is difficult to remove a tick when he fastens on one, as the head keeps a very determined grip, and parts company with its body sooner than leave go, and, there remaining, sets up a very nasty and lingering sore.

UP TO THE MIDDLE OF MAY WE PLANTERS WERE UNHAPPY

—that is to say, nine out of every ten Europeans in the province; for except the few officials and railway men, all whites here are concerned with tea in some way or other. The early rains had been extraordinarily late and scanty so far; the drought had lasted since last October, everything in consequence was very backward, and estate managers were wondering how their estimated crops were to be obtained.

Even a shortage of the usual crop means very great loss, as the English capital invested in tea is over fifteen millions, and a short crop does not mean a proportionately reduced expenditure on the estates, as the cultivation has to be kept up at the same standard of excellence, the need for this in a bad season being greater indeed than in a normal one, and we cannot discharge any of our labour force, shortage of labour being in normal times a great crux with us. Writing now in July, we are having a very trying year. The

RAINFALL HAS BEEN EXTRAORDINARILY SHORT,

and everyone is doing badly and making less tea than usual. I am already 11 tons behind, and still going back, and, as there is no retrenchment possible in management, we have to find full work for our coolies, whether it be remunerative or not. The shortage of labour is becoming more acute year by year.

EVERY COOLIE HAS TO BE IMPORTED FROM OTHER PARTS OF INDIA

at the expense of the garden, and may amount to £10 per adult. The average garden is about 600 acres—say, a square mile—and there should be at least one-and-a-half cooly per acre for decently efficient cultivation. Matters have not been improved by the recent repeal of a part of the Special Labour Law, which allowed of a coolie being put under contract to serve for a certain period, with penalties for non-performance, drunkenness, and absconding. *Per contra*, the employer was and is bound to provide wages, food at fixed prices and good quality, proper housing, and especially a good and pure water supply, with medical attendance and maintenance when sick, and the coolies start work quite free of debt of any kind to their importer—the garden. All estates are regularly inspected by the district officials, and due performance of their part of the now unilateral contract is rigidly enforced. Since the above repeal, we have hardly any hold on the coolies except by a cumbrous civil suit, which is only possible if a cash advance has been made and the coolie refuses to work at all. Considering that every coolie has been and still has to be imported by us—the native Assamese being quite useless—it seems rather hard that we should have no security that they will remain long enough on the estate to prove remunerative. We cannot in any way recover the cost of their importation from them. They start free from that.

THEN THE GOVERNMENT STARTS UP, BIDDING FOR OUR COOLIES,

much having been talked about State colonisation of Crown lands, but nothing effected, except in the way of inducing the men whose passages we have paid for, to take up Government waste lands, and the result is that enormous areas of such land have been taken up by ex-tea garden coolies, amounting now to 120,000 acres and more, these men being appreciated by the authorities as the best ryots in the province, and from them the Government draws a large and increasing revenue. There are still huge tracts of richly fertile lands hungering for tillage, and more capable of giving certain returns than the major portion of India itself. First and last we have imported more than a million people from India, nearly all of whom have ultimately decided to finally settle in the province, and this we still continue to do at the rate of many thousands annually.

THE NATIVE OF ASSAM IS USELESS;

practically none will work save as clerks or on some such billet; they have a most inordinate idea of their own superiority over the rest of the races of mankind. Heaven knows for what reason, for they are lazy, dishonest, and in no capacity reliable. The Bengali, on the other hand, though in moral character no better and perhaps, because of his mental superiority, requiring more intelligent supervision, will and does work. It is customary to laugh at Babu English, and their stilted style and use of half-comprehended Johnsonian phrase is productive of most ludicrous results, of which I could, of course, produce many perhaps better examples than the following: "Sir, I beg to crave a small hole in the secret side of your benevolence wherein I may creep and thence derive sustenance for self and starving family," &c. But, *per contra*, apart from our officials, not one in a hundred Europeans knows how to address a respectable native without unwittingly insulting him by the use of terms grossly inappropriate.

We are

JUST COMPLETING A LITTLE WAR ON THE FRONTIER.

The Daflas, a Himalayan tribe of ancient "head-hunters" who in the past have been in the habit of raiding the Assam plains much to their own advantage, came down on a Miri village in the Darrang District a short time since, acquiring some fresh heads, and carrying off a few

individuals into slavery. A party of our native troops sent up into their hills may burn some of the more accessible villages, but that will be all the result, for it is impossible to catch these cragsmen in their own fastnesses, as they never show fight, so most likely no one will have been hurt. The most severe punishment will be inflicted on these Daflas by withdrawing their license to trade in the valley for a term of years. They are very jealous of allowing strangers to enter their territory, anyone so doing being promptly enslaved and seldom heard of again. For that reason no British subject is permitted by us to cross the boundary line. Quite recently three or four Thibetans arrived at our Bunjur outpost in North Assam, they being the remains of quite a large party of their traders who had been captured by these Daflas many years ago. It is supposed that many unfortunates among our absconding tea garden coolies have "bettered themselves" by wandering over the border, whence they can never hope to return, and are not heard of again. Luckily our people have been successful in preventing the gun trade with these hill tribes; otherwise we should be confronted with a Far Eastern Afghanistan, for they are hardy races, but as yet are armed with but a few fortuitous guns of sorts, bows, and arrows, spears, and dhas being their most formidable armament, since so far they possess no rifles. Speaking of

FIREARMS,

our indiscriminate allowance of these to the natives of our settled States has resulted in the upset of nature's balance. The native shikari (or often village loafer), armed with a rifle or gun, hardly interferes at all with the tiger or leopard, but in many parts has nearly cleared off the land, all the more—to him—profitable deer and pig and wild bovine animals, which are the natural aliment of the felidæ. The consequence is that these now support themselves almost entirely upon the natives' flocks and herds, and—more frequently perhaps than of yore—upon the native herself. I think they are quite as numerous as they were twenty years ago; at least, they fall quite as often to one's rifle as ever they did. The tithe they take of domestic cattle is enormous, however, so it comes to be one's duty to so far as possible to police the district, if one has a steady hand. Both tiger and leopard are epicures, and kill nothing but the best, to the great grief of the poor ryot, who often longs for the return of deer and pig to shield his herds. So much for free trade in guns, untempered by a proper license system.

One reads a deal about the

GREAT CAT'S FAVOURITE KNOCK-OUT BLOW, WHEREBY HE SLAYS THE BISON

(here standing 6ft to 6ft 3in at shoulder), buffalo and ox with one skull-smashing blow. At an extremely low estimate I have examined over 300 kills, and in not one have I seen a sign of the paw being used except to catch and hold the prey; even scratches on a kill are rare and small as a rule. In ninety-nine cases out of a hundred the throat seemed to have been seized from below and the neck dislocated by a sharp twist by the paw. Neither beast seems, as far as I know, to spring upon its prey, but by preference after getting as near as possible, makes a final short rush along the ground, seldom chasing for any distance if foiled, but depending on a surprise. The vitality of both animals may well be a source of perennial surprise. But a very short time since I

HIT A TIGRESS WITH A 577 EXPANDING BULLET,

striking behind the shoulder, and raking slightly back. The heart and lungs I found blown to bits, yet she made a rush towards the smoke, turned back, and went fully fifty yards through a dense mass of reeds, finally hiding herself so well with her last breath (if she had such then at all) as to be invisible, from a few feet away. This may seem incredible save to old shikaris.

One reads magazine yarns of fellows shooting "many" tigers on foot and alone. They always aim, and hit, between the eyes! Seeing what the attitude of a tiger is when both eyes are visible and the trend of the forehead, &c., I know that no experienced man would choose such a shot. I have been fairly successful in my quest for Mr and Mrs Stripes, but it is my firm opinion that no man would on foot try this shot on "many" tigers and live to relate his successes. A day or two ago I went after a herd of thirty bison, as we call them (of course, quite different from buffalo, as you know), and got a head the owner of which stood 6ft 3in.

ASSAM.

TEA IN CHINESE TURKESTAN.

From the report on the Indo-Chinese Turkestan trade *via* Ladakh for the year ending on the 31st March, 1909, by Sir Francis Younghusband, K.C.I.E., who has just gone home on leave, we extract as follows:—. . . It will be a great day for our traders when Indian tea is allowed to enter Russian Turkestan, because it will completely oust the tea now drunk in that tea-drinking country. The tea which is drunk there at present suffers deterioration by the sea voyage to Batoum. . . .

IMPORTS FROM INDIA TO CHINESE TURKESTAN.

Tea was not imported in such large quantities as last year. The market was good and the rates fair. There will be a great future for Indian tea if it could be taken into Western Turkestan *via* Kashgar. It is to be hoped that the prohibition will be taken off before long. The demand for Indian tea increases yearly, and it is difficult to understand why traders do not import more. Probably the transport question has a great deal to do with it.

Four qualities are imported:—

1 Palampur green, 6¼ Tengas per Ching.
2 Pata from Palampur. 5 Tengas per Ching.
3 Pamila from Dehra Dun. 6 Tengas per Ching.
4 Brooke, Bond & Co.'s Orange Pekoe. 5½ Tengas per Ching.

Nos. 1 and 3 are most in demand. The tea-drinkers of this country state that tea deteriorates by a sea voyage, and therefore they prefer the Indian tea to that which comes through Western Turkestan after a sea voyage as far as Batoum. Our traders import a small quantity of "Ak-chai," Chinese tea. It has not much sale except amongst the Chinese who pay as much as 16 Tengas per ching for it.

A. R. B. SHUTTLEWORTH, Captain, Offg. His Britannic Majesty's Consul at Kashgar.

TEA IN LADAKH 1908-9.

LHASA BRICK TEA.—A large increase R65,472 between 1907-08 and 1908-09 is shown under this head which, as I have said, I put down to the inefficiency of the registration post at Nima Mud and consequently consignments getting entered twice over in the books at Leh. Two new registration posts with a proper staff have recently been sanctioned for the Tibet frontier, and the returns for trade with Tibet should in future be more reliable.

TEA INDIAN.—The figures are given below:—

(1) Exported from British India to Ladakh—

		Mds.	Value
1907-08	...	2,374	61,705
1908-09	...	1,110	33,246
	Decrease	1,264	28,459

(2) Exported from Ladakh to Central Asia—

		Mds.	Value
1907-08	..	1,277	34,952
1908-09	..	546	16,382
	Decrease	731	18,570

CHINA TEA, VIA INDIA.—One hundred and ten maunds were exported to Chinese Turkestan against 85 maunds during the previous year. —*Indian Trade Journal*, Nov. 25.

TEA CULTURE IN VARIOUS CLIMES.

CHINESE AND OTHER METHODS.

A most interesting and well-illustrated article on tea culture is to be found in the pages of the November issue of "The Magazine of Commerce"; and, although the figures are not in every case correct, it well repays perusal, containing, as it does, informative descriptions of the culture and manufacture of the leaf in the various countries in which it is grown. Brick tea, for instance, which is extensively used in Tibet and some parts of Russia, is prepared in a very rough and ready manner, being formed of cheap and coarse teas which, with small twigs, are compressed into blocks. Very little care is exercised in the plucking process, the twigs being literally reaped from the plant. There is no withering or regular fermentation process. The twigs and leaves are at once heated in thin iron pans for a few minutes, and then tied into bundles and sacks, and taken to the factories or "hongs," where the material is piled in heaps and allowed to ferment. After being dried in the sun the tea is sorted into grados, when it is steamed and finally pressed into a shallow brick-shaped mould by means of a heavy rammer. In three or four days the bricks have become quite hard, and, aftor being stamped with the maker's name or device, are wrapped in paper and made into strong packages for transport. Large quantities, some 20,000 tons per annum, are made at Hankow for the Russian market, which is also supplied with "tablet tea" from the same town. Another country, in which the manufacture of tea does not proceed on what we may term orthodox lines, is Japan, where shade-grown tea, that is, tea grown under horizontal mats, is cultivated to a large extent. None of this, however, finds its way abroad, for it is so highly valued by the Japanese that it is grown exclusively for home consumption. A similar method is practised in South Carolina and Java, the bushes being under a covering of jute hessian from 10 a.m. to 4 p.m. The purest of all tea, that least touched by the human hand in manufacture, is the virgin tea of China. It is prepared exclusively from the very youngest leaves of the shrub, and is used principally at Chinese marriages. So delicate are the leaves that even after prolonged boiling but little tannin is evident. The leaves are tied together with silk thread in tiny bundles. When the tea is to be brewed, a bundle is held by means of a small ivory or silver skewer, in a large clear crystal cup of very thin glass, and boiling water poured in. The leaves slowly unfold, and, changing from a dingy greyish-black colour, quickly revert to nearly the same refreshing greenness which they possessed when plucked. The infusion, as seen through the glass, is of a pale amber colour, resembling that of the finest qualities of cognac. It is drunk directly from the leaves, the aroma and odour being obtained to perfection. The difference in the manufacture of Chinese green and black tea is, it appears, extremely small, the same process being adopted in both cases, until the rolling has been completed. The leaves intended to produce black tea, however, are subjected, after rolling, to a much more extended drying process in the open air than the green leaves, and thus undergo a process of fermentation which does not obtain in the manufacture of tho latter. Rolling, it is to be noted, is done by hand, the leaves being workod and kneaded like ordinary bakers' dough. It is also, when finally placed in boxes or baskets, pressed down by men treading it with their feet, which, says the article, are covered with clean cloth or straw shoes. We wonder if this is always the case. The story of the rise of the tea industry in Ceylon is succinctly but well written up, and the enormous strides made in India are described. Natal is mentioned as the most important tea-producing colony of the British Empire after Ceylon and India, notwithstanding the fact that the acreage has not yet reached 5,000. This will have to be increased at least threefold in order to satisfy the local demand and capture the South African market. The most productive gardens are at an elevation of 1,000 feet, the land at this altitude being generally of an undulating character, well watered, and the climate sufficiently humid to encourage leaf production. As the tea is of good quality, the industry is of considerable value, despite the small acreage, and should do not a little to further advance the prosperity of the "Garden of South Africa."

AGRICULTURAL DEVELOPMENT IN ASSAM.

An interesting agricultural development reported from the Lushai Hills in Assam is the expansion of valley cultivation in that region. It is stated that the erstwhile swamp, filling the valley of the Tuipui river, has now been drained and brought under successful rice cultivation. The pioneer of the movement is said to be an ex-Sepoy, who undertook to teach the Lushais how to grow wet rice, and succeeded admirably.—*Madras Times*, Oct. 31.

ARTIFICIAL CULTIVATION OF SPONGES.

U. S. A. COMMISSIONER'S SUCCESS.

PRIVATE CO. ORGANISED: METHOD EXPLAINED.

Washington, Oct. 22, 1909.—The United States Commissioner of Fisheries in his coming annual report will make the interesting announcement that the work of the bureau in testing the practicability of the artificial cultivation of sponges has reached a point justifying commercial exploitation of the bureau's methods on a large scale. The commissioner will say :—

"Such progress has been made in experimental sponge culture at certain points on the coast of Florida that the bureau is now in position to recommend the growing of sponges from cuttings as commercial enterprise, and will shortly make public the methods and outcome of the experiments that have extended over a series of years. The outcome of the past season's operations has been the production of marketable sponges, and of an average weight of one-and-a-quarter ounces, in twenty-nine months. It is understood that a private company has already been organised to carry on sponge culture on a commercial basis, following the methods made known by the bureau; and it is believed that very important economic results must accrue to prospective sponge planters, while at the same time the stability of the sponge crop is assured."

The work of the Bureau of Fisheries in the artificial cultivation of sponges has been conducted by Dr. H. F. Moore. These are the only tests ever made in the history of the industry either here or abroad that promised to be of commercial importance, and were undertaken in January, 1901, at Sugar Loaf Key, and at other places in Biscayne Bay, Fla. Growing from cuttings was adopted because of its simplicity and the certainty with which the cuttings will attach and regenerate when placed under suitable conditions. After numerous experiments it was finally established that pieces about 1½ by 2 by 2½ inches were most suitable. These cuttings were placed on wires formed by various materials, each piece being slit by a sharp knife, and fastened astride the wire by a bit of aluminium wire. In about six weeks after submergence in the sea the cuttings have been found to heal, an outer skin formed over the entire cutting and a slow but steady growth begun. Various kinds of wire have been used and abandoned for various reasons. The greatest measure of success in the growing of sponges suspended in the water has followed the use of a galvanised iron ribbon three-eighths-of-an-inch wide and one-sixteenth inch thick encased in a tight fitting jacket one-thirty-second of an inch thick. The ribbon obviates the difficulty encountered in the use of a round wire when the sponges reach five inches in diameter, when they are loosened by the action of the waves and begin to rotate, thus wearing large holes which damage them commercially and retard their growth.

In many localities, however, the growing of sponges on wires suspended in the water has been found less practicable than to mount the cuttings on flat discs or triangles made of cement. These cement forms can be made at an expense of less than two cents each, including labour and material. The cuttings were attached by means of a wire. On some grounds, where strong currents were encountered, resulting in some shifting of sand and silt, which threatened to bury the disc and cutting it, it was found desirable to mount the cutting on a spindle made of a short length of the lead covered iron ribbon. The use of discs and triangles, all things considered, would appear to promise better success on a commercial scale than the method of suspending the cuttings on ribbon wires, but much depends on the character of the bottom, the prevailing currents and other considerations.

Under artificial culture the shapes of sponges may be modified more or less to suit the special requirements of the arts. Sponges grown on wires or spindles assume a spheroidical shape with a uniform texture of surface and devoid of any semblance of a "root" such as is found in all natural sponges excepting rollers. This form is very attractive and durable.

Cuttings grown on discs tend to assume a flatter shape, and the surface attached to the cement is plane, and in that respect resembles the root of natural sponges, but instead of being "raw" and exposing the canals, it is covered with a close soft felt of great strength and durability, and forms the strongest, instead of the weakest, part of the sponge.

In certain arts and trades sponges with flat surfaces are required, and to obtain these it is customary to cut the "forms" into pieces. The raw surfaces exposed in this way lack the durability of the natural surfaces and to obtain the latter style at the same time retaining the several flat faces and sharp angles of the "cuts" a modified form of disc is employed. In these there are two partitions raised to a height of four inches crossing one another at right angles on the upper surface of the disc. This leaves at the centre of the disc four angular compartments, and in each of these a cutting is planted, which being limited on three sides by the disc and partitions, grows into a form having three plane surfaces at right angles to one another and one convex surface. The latter is similar in texture to the outside of an ordinary sponge, but the plane faces form contact with the disc and partitions and develop a smooth, soft and very durable felt-like surface. These sponges cost more to grow than those of ordinary shape, but experiments recently inaugurated will probably make the additional cost of production trifling. The superior durability of sponges grown in this manner will make it possible to market them at a price considerably above that brought by the natural product.—*New York Oil Reporter*, Oct. 25.

EXPERIMENT STATION IN SUMATRA.

To Devise Means to Cope with the Diseases which Attack Rubber Trees.

Rubber planters in Deli have agreed to establish an experiment station there. The preliminary outlay is set at 30,000 guilders, spread over three years. It is intended to engage a botanist learned in biology who, after gaining experience in Ceylon, the Straits Settlements, and Java, will at once set to work to devise means to cope with the diseases which attack rubber trees. Contributions to meet the outlay are expected from every estate according to the area. The number of estates is about 80 spread over about 30,000 acres. Twenty-two planters have fallen in with the idea and a Committee has been appointed to settle the details.—*Straits Times*, Dec. 3.

A FRENCH VIEW OF RUBBER:

BY A FRANCO-AFRICAN AUTHORITY.

"PLANTATION RUBBER MUST DOMINATE THE POSITION."

(Specially translated for the *Financier.*)

[In a recent interview with the representative of a Paris contemporary Mr Engeringh, who is the administrator Delegate of the Sultanats du Haut-Oubanghi (French Congo) gave expression to some very interesting opinions as to the present position of the rubber industry and the future of plantation rubber. Mr. Engeringh, we need scarcely add, from the position he holds is exceptionally well placed to offer an opinion on the subject. He is connected with several rubber plantations, but prior to acquiring these interests he was for a long time head of some of the pricipal Congo Companies. With his experience, then, of both "wild" and cultivated rubber his views on the outlook should prove of interest to our readers.—Ed., F.]

"What strikes me most in the present position of rubber," said Mr. Engeringh, in reply to the obvious question of his interviewer, is that, in addition to the increase in the consumption of the commodity reflected in the high prices now ruling, there is a quasi-certainty of a slow but very decided movement on the part of the main rubber cultivation to migrate. South America has been up to the present, and still is, the great rubber producer. The share of the Congo is not insignificant, but it is negligible, amounting to 5,000 to 6,000 tons a year, compared with, roughly, 40,000 tons from South America. Therefore, it is to South America that we must turn our attention if we would study the production of forest rubber and the gathering thereof. Well, it appears to me that this harvest of the forest is not likely to increase. Without seeking to bring out technical reasons (which are, however, of themselves very weighty), I will confine myself to naming this one fact, which appears to me to be the most tangible proof.

STATIONARY SOUTH AMERICAN OUTPUT.

In spite of the great rise that the prices of rubber experienced for two years—which should have been a great stimulant to the producers, as it assured them of large profits—statistics demonstrate conclusively that the production in the regions named has remained stationary. Let us take the four past months—July 1st to October 31st, 1909—that is to say, the time when rubber reached its highest price. The production in that period in the Government of Para reached the level of 8,560 tons. During the corresponding period of 1907, when the price was 3s. less per pound, the production was 8,480 tons—that is to say, practically the same as this year. It is obvious, then, that if more is not produced at this time, it is because it cannot be done. The temptation is strong enough. The Government of Para, on the other hand, is getting alarmed at the extravagant production, which, it is feared, will reduce the subsequent producing capacity of the country. It is endeavouring to stop the excessive tapping of the *lianes* [*sic.* This term is usually applied to rubber *creepers* and not to the *Hevea* trees of Para.—A. M. & J. F.] and so to protect the future.

"From the fact that this production does not appear to grow, but rather to maintain itself with considerable difficulty—and there is, besides, the question of labour, which is always rare and difficult to obtain in South America, and is in many parts a very disquieting problem—it is clear that the consumption, which continues to grow, must turn elsewhere for satisfaction. On the other hand, it is natural that the progress of consumption is much less than it would be because of the high prices quoted, which prevent the employment of rubber in many industries. In my opinion it would be a great advantage if the price of rubber fell to about 15 f. per kilogramme (5s. 5d. per lb.) At this price the profits of the producers, particularly in the plantations, would be enormous, and the market would be unlimited. When the price of rubber is more approachable, the consumption will receive such an impetus that we may be able to count on, I believe, an annual increase of 10 per cent. Even if we only estimate the advance at 5 per cent per annum, we would have an increase of 50 per cent in 10 years, which is not exaggerated. Everybody knows that the uses to which rubber is put are increasing in number constantly." Here Mr. Engeringh quotes a number of applications of rubber, actual and prospective, and proceeds: "I am convinced that the consumption of rubber will make enormous progress, and what is not obtained from the exploitation of the forest reserves of South America will be provided by the rubber plantations. There is where its future lies, and thus I am able to tell you that its centre is going to change its geographical position."

"SYNTHETIC" RUBBER.

"Have we anything to fear from the competition of 'synthetic' rubber?" asked the interviewer.

"No; I do not believe in it at all," said Mr. Engeringh, "and I am not alone in my opinion. This is also the opinion of M. van Romburg, Professor of Organic Chemistry in the University of Utrecht, formerly Director of the Botanical Gardens of Batavia. All efforts in this direction by chemists have been hitherto fruitless. Materials will probably be found that will answer the description of impermeableness, and may compete feebly with rubber, but their influence will be insignificant. As to finding a product that will possess the same qualities as rubber, with its essential characteristic elasticity, that appears to be but a Utopian idea."

MIDDLE EAST PLANTATIONS.

"Plantations will increase," continued Mr. Engeringh, in reply to a further query, "but numbers of them will be disappointing." Proceeding to outline the conditions required for their success, he found that the Middle East presents ideal conditions for rubber cultivation, and—an important point—there is plenty of labour there. The populations in many parts are already agricultural and industrious, and quite adapted to plantation work. Furthermore, labour there is cheap. He then recounts the progress of the plantations up to the present (which part of his narrative we need not

reproduce) and observes that the cost of production is naturally very varied. But the price of rubber is so high compared with production costs that the disparity explains the large dividends already paid by some Middle East companies almost as soon as they started to market the product.

The interviewer made inquiries as to Mr. Engeringh's opinion of the standard of value.

"Will Para," he asked, "always be the standard for plantation rubber?"

"On the contrary," said Mr. Engeringh, "there is generally a margin in price in favour of plantation rubber, as it is purer. In any case, the better grades are never sold cheaper than Para."

"In such case," continued the interviewer, "the plantation investment appears to be so inviting that more will be started, so there might easily be a danger of over-production?"

"Up till now there is nothing to fear," replied Mr. Engeringh. "Stocks do not grow, and, as a matter of fact, the Middle East plantations are at present supplying a very small quantity compared with the world's total. But, allowing for a rapid increase, this will only provide for the growing consumption, and it will no doubt be easily absorbed."

Our authority does not believe that the forest production will remain at its present level, but that, on the contrary, it will decrease, which tendency it is clearly showing, with the exception of certain regions—for example, the Congo, where both the French and Belgian Governments have made wise provisions in the concessions as to the re-planting of the rubber areas as they are used up. This will no doubt ensure the maintenance of the level of production in Africa. But it is not so in South America, where the tendency to fall off in the production is very significant.

THE FUTURE OF THE MIDDLE EAST.

"But again, as to the indefinite increase of the plantations in the Middle East, that," said Mr. Engeringh, "is impossible. They require special clearly defined conditions for their success, and these conditions will only be found in a limited number of areas. The best lands are already taken. The existing plantations that have reached, or very nearly reached, the production stage may be called privileged. They have not any serious competition to fear, and, in spite of the efforts made to increase their yield, they will do no more than meet the demand that is growing so wonderfully. I do not believe there is any cause to anticipate an accumulation of stocks. I believe present prices will be maintained, and, if the present growth in the demand, estimated at the moderate rate of 50 per cent in 10 years, continues, the plantations which have yielded 2,500 tons last year will have to give us 35,000 tons in ten years. Those who like to juggle with figures will no doubt be able to show that in 10 years their yield will be 70,000 tons. But allow me, as a man understanding the business, to doubt it. Remember what I told you—that rubber requires special conditions; besides, we must take into account with the rubber plantations the usual mistakes that occur on the average with industrial enterprises. The liability of humanity to err must be taken into account. In fact, we must reconstitute methodically the accumulation that Nature has taken many years to perfect in the immense forests that are now being exploited. That will take time. . . . One thing is certain; the future of the rubber plantations is assured for a long time, and the centre of production is being gradually shifted towards them."—*Financier*, Dec. 13.

RUBBER PRODUCTION IN ANGOLA.

The following information is from the report by H.M. Consul at Loanda (Mr. H G Mackie) on the trade of Angola in 1908, which will shortly be issued:—

WILD RUBBER.

Careful investigations have been conducted by a Government botanist in the regions lying between the rivers Cutato and Cutchi and the Cubango and Cului on the plateau of Benguella. Among the numerous latex-yielding plants collected, the most promising rubber plant is said to be a shrub (*carpodinus gracilis*) growing in shady places on a soil with no rocks or stones, but having a deep layer of sand free from stagnant water. This shrub furnishes a rubber of good quality, which is extracted by the natives by beating the rhizomas (horizontal trunks) between two pieces of wood—one having a flat surface and the other shaped like a mallet. The bark is thus separated from the wood and reduced to fragments held together by the rubber tissues, the globules of caoutchouc coagulating as soon as they come in contact with the air, and thus none of the latex is lost. As soon as the bark that contains the rubber is peeled off, the native continues the beating operation until the whole is reduced to a spongy elastic mass, known in the trade as a "manta" or sheet. The "manta" at this stage consists of the rubber threads binding the broken bark that has been reduced to dust. It is now worked in cold water and again beaten. Repeating this working and beating process, the native is able to prepare a physically almost pure rubber—by means, however, of great labour. For this last reason it does not always pay him to clean the rubber too much. After this working and beating process the spongy mass turns into a flaccid rubber sheet of less than half-an-inch in thickness and sometimes as much as 4 feet square. This rubber sheet is now steeped in boiling water for some five minutes, when it becomes quite plastic, and in this state is shaped by hand into its characteristic sausage-like form of about 10 inches in length. Although the water is pressed out as much as possible during the modelling operation, the rubber still contains 30 per cent of moisture, which must, of course, be evaporated if the rubber is to be preserved from damage. The drying of the rubber has to be attended to by the buyer. The native frequently collects big loads of stems and rhizomas in the cold and dry season far away from his village. These loads are brought in and

stored for weeks before the rubber is extracted. If there is much dry material to work, it is immersed overnight to render the bark more malleable and less adhesive to the wood.

The rubber in question is classified as second class rubber in Angola, as it is usually badly cleaned, *i.e.*, full of particles of bark. A first-class product could be obtained from this plant in Angola if the natives would take the trouble to cleanse the rubber more than they do.

One-fifth of the ground traversed by the Government botanist between the Cubango and the Quembo, an affluent of the Cuando, is covered by this plant, from 16 deg. south latitude to the Congo Basin; it thrives better, however, in some localities than in others.

THE ROOT RUBBER

industry, entailing a great amount of manual labour, is essentially a black man's industry, but the methods of extracting and preparing the rubber leave much to be desired. The employment of machinery would, no doubt, help to solve the problem, but the lack of means of communication is at present the chief obstacle to the attainment of a higher standard. Moreover, the country is not yet occupied, and the natives are much too uncivilised at present to admit of much improvement. Rubber is gathered over a vast expanse of country by the natives, who carry it on their heads to the up-country stores, where they barter it for other goods. These stores are situated in the populous centres and follow up the trade, the merchants moving from one district to another as circumstances may require. In 1903 a European bought 26,500 lb. of rubber in the populous valley of the Cuango, an affluent of the Kuito; soon afterwards three Portuguese factories started business on that river. The produce is likewise brought in by Boer wagons, the Portuguese traders using these conveyances for penetrating the unoccupied regions for hundreds of miles.

In a previous report (see pp. 243-4 of the *Board of Trade Journal* of 30th January, 1908), reference was made to an asclepiaceae rubber, of which samples were sent from Angola to the Commercial Intelligence Branch of the Board of Trade, with a view to inducing manufacturers in the United Kingdom to quote for machines and implements for extracting the product. A British rubber company has recently embarked upon this enterprise, and the machines are now on their way out to Africa. The rubber grows on the Burro-burro plain of the mainland of Benguella, which the railway is about to cross. The percentage of rubber is very low, being only some 2½ per cent, but with the mechanical process about to be applied better and more rapid results will doubtless be obtained. The British firm is also sending out rubber cleaning plant, for erection on the coast, that should extract about 45 per cent of dirt and bark from the native rubber, which has up to now been paying freight and export duty.

CULTIVATED RUBBER.

In the forest belt of the Loanda district endeavours are being made, on the initiative of the Government, to cultivate Para, Panamá and Lagos silk rubber trees, and in 1907 and 1908 seeds and plants were imported for purposes of distribution. An experimental station, under the direction of a botanist from Kew Gardens, has been established at N'Dalla Tando, a station on the Loanda-Malange Railway, for the purpose of rearing and distributing such economical plants as are likely to thrive and become useful for the general development of agriculture in Angola. Various other agricultural experimental stations have been set up in various parts of the colony, and a laboratory has been established at Loanda in which researches can be made.

With regard to cultivated rubber, it may generally be said that, while there are indications pointing to a handsome return in the future, the industry is still in an experimental stage of development. Mainly owing to the small yields of the present system of tapping the *manihot glaziovii*, only poor results have been attained by planters on a small scale, who have not been able each to produce more than a few pounds of rubber for shipment to markets where many tons could be easily disposed of. The better-yielding species—such as the Para, Central American and Lagos silk rubbers—have still to attain a sufficient age to permit of their being tapped.—*Board of Trade Journal*, Dec. 16.

RUBBER AT THE BRUSSELS EXHIBITION.

It has been decided to open the Brussels International Exhibition in April, 1910, and to continue until November of that year. We recently had the pleasure of paying a visit to the Belgian capital in order to see exactly what was being done.

The old museum at Brussels which hitherto has been used for general exhibits from the Congo will be cleared and used expressly for

EXHIBITS BY PLANTERS, RUBBER COMPANIES

and others. The room is divided into separate compartments and each of these will be reserved for separate countries, viz., Borneo, South India, Ceylon, Malaya, Java, Sumatra, etc. The middle of the room will be filled with an exhibition of educational value, having at one end collections of various rubber seeds, trees of various species and of different ages; tapping the rubber trees will come next; then washing and curing, and finally the manufactured articles in daily use will be shown.

EVERY STAGE FROM THE SEED

of the rubber plant to the finished tyre will be shown in the middle of the room. Each section around the whole of the museum will, as indicated above, be used for exhibits of rubber from separate countries. Here the various companies throughout the world will be represented, and a very good collection should be on view. One compartment will, according to present intentions, be devoted to a display of the scientific implements and apparatus used in testing various rubber goods and another to literature dealing with the plantation and manufacturing industries.

This feature—a section reserved entirely for planting exhibits—will in itself be quite unique. —*India Rubber Journal*, Dec. 13.

RUBBER IN JAMAICA: IS IT A FAILURE?

The usual monthly meeting of the Board of Management of the Jamaica Agricultural Society was held at the office of the Society, No. 11, North Parade, Kingston, on Thursday, 21st October, 1909, at 11-40 a.m. Present:—H. E. Sir Sydney Olivier, in the chair, His Grace the Archbishop, Bishop Collins, Hons. L J Bertram, Geo. McGrath, the Director of Agriculture, Messrs D Campbell, R Craig, A W Douet, A C L Martin and the Secretary, Jno. Barclay.

Mr Craig—said he had given notice to the Socretary to place on the agenda that he would bring up the question of the

REPORT OF THE DIRECTOR OF AGRICULTURE ON COTTON AND RUBBER

in Jamaica, as published in the *Gazette*. He did not say, as he did not know, that Mr Cousins might not be perfectly right in making the statements he did, but he happened to know that large sums of money had been invested here in rubber planting. It was only within the last four or five years that there had been rubbor-planting to any extent done here, and three of these years were years of drought. Mr Cousins might be quite right in giving off these *ex cathedra* statements, but he would ask him to give them some data.

The Secretary also submitted two further letters he had received on the subject:—

Mr A B Ventresse wrote of date: On pages 261 and 262 of the *Agricultural Journal* for July, I read: We can supply cotton seed, etc. The Society is prepared to supply seed and pay cost of cultivation, etc. We have districts to which cotton would be a valuable asset if it were grown. This year a few cultivations of cotton in Jamaica have done well. In the supplement to the *Jamaica Gazette*, September 2nd, p. 272: I would add cotton to the *Index Expurgatorius* of economic crops for Jamaica. . . . Cotton cultivation is one of the most speculative and uncertain agricultural enterprises ever attempted in Jamaica, This by the Director of Agriculture.

Will the Board be good enough to reconcile these statements. If not, why not? And what is the economic effect on the Island? And in the opinion of the Board, should cotton be condemned in this manner? And is it to the general interests of the country that such statements should be issued with the authority of the Director of Agriculture?

On page 271 Supplement to *Jamaica Gazette*, September 2nd, the Director of Agriculture says: I am unable to recommend the cultivation of any rubber-producing tree yet tested in Jamaica. Is it not to be inferred from this that all the rubber planted will be a failure? If not, why is it written? On page 292 same issue: Planters have been ill-advised to spend money thereon. Who advised this planting? Same page: Castilloa is apt to die if tapped at all severely. Is there good evidence of this, and if so, why is it not published, and is it from Jamaica experience? Same page: Rubber as a shade for cocoa has proved most pernicious? Does this apply to Tobago, and in what way is it pernicious? Is this wholesale condemnation of rubber a good policy for the Director of Agriculture to pursue at present? And what is the effect on the value of properties?

Sir Edward Cornwall, Chairman of the Jamaica Estates Company, says:—Arrangements will at once be made for the supply of rubber plants. . . . We have instructed Mr Farquharson to proceed with the planting forthwith.

Whose duty is it to tell these outside investors that they don't know what they are doing? Surely they should be protected against themselves! Will the Society advise?

I address this to the Board because I think the Society should make some move in the matter.

Mr R E Gillespie of Clyremont, Falmouth, wrote of date 19th October, 1909, saying he had determined to give up cotton growing for two reasons—(1) that no one in his district would take up the industry, though to be successful it needed a certain amount of co-operation and (2) he was disgusted with the report of the Director of Agriculture on cotton, as published in the *Gleaner* of September 3rd. It might be correct for other parts of Jamaica, but he believed from experience that cotton was a most useful, safe and profitable crop in his district. However, the above-mentioned report will effectually damn all hope of anybody trying it, so I must drop it also. I shall give off my September crop in a few days and shall then be ready to hand over the gin.

The Director—in reply—said *Hevea* plants had been regularly issued to the public from his Department for over 25 yoars, but there were no large trees to be found anywhere, although Castilloa trees were growing freely from similar means of distribution. The largest Para rubber tree in Jamaica was at Castleton Gardens and is now 30 years old. It should yield at least 10 lb. of rubber per annum, if *Hevea* was a normal tree for growth in this island. Castleton has the closest approximation to a Brazilian rubber climate of any district in the island. This tree yields latox with great difficulty and refuses to give an appreciable yield of rubber. The manager of some very large Para plantations in the East, inspected growing Para rubber trees in various parishes of Jamaica in March last. He told him (Mr Cousins) that our six-year-old trees were only equal in size to 16 months' trees on his plantations. He also stated that lack of rain for 10 days is a serious set-back to *Hevea* as grown on modern lines for rubber production. His conclusion was given to him: "Jamaica is quite unsuitable for Para rubber." A Belgium syndicate went in largely for Para rubber plantations near Port-au-Prince

IN HAYTI,

some eight years ago. The manager was personally known to him, and on a recent visit to Jamaica, he informed him that this rubber tree failed to produce a normal bark and latex in Hayti, and the Para rubber had been given up for cocoa, which was doing well. The greatest interest in rubber-production in the West Indies, had been evinced

IN TRINIDAD.

The climatic conditions in Trinidad were more favourable for Para rubber than those of Jamaica. The managing partner of one of the largest properties in Trinidad, was good enough to tell him of their experience of *Hevea* and *Castilloa* when this gentleman visited Jamaica last Spring. He stated that he was quite satisfied that the *Hevea* they had planted, on quite a large scale, could not be a commercial success and he regretted the money expended on this exterprise. He also informed him of the serious injury to his cocoa trees by planting *Castilloa* rubber as shade. The climate of Jamaica had too low a mean temperature and too great fluctuations in humidity and rainfall to reproduce the conditions in which *Hevea brasiliensis* grows naturally in the Valley of the Amazon and those in the East, where cultivated Para rubber is at this moment coining money for the enterprising planters who had created this industry. The mere growth of a rubber tree and its ability to yield latex capable of giving rubber in a commercially profitable quantity, are two different things; and there was every reason to believe that while we could grow Para rubber trees here of poor and stunted dimensions, that it was not possible in Jamaica

to grow *Hevea brasiliensis* so as to yield good latex freely. That these were the considerations that led him as a matter of duty to the public, to record the opinion which has been called in question. With regard to *Castilloa elastica*, the chief points he made were as to its being a serious source of vermin (scale insects) and of its "sucking" cocoa when planted as shade for that crop.

Mr D CAMPBELL said he had visited Costa Rica and found Castilloa Rubber trees there that had been tapped and tapped for years with rough treatment until they were all scars and yet they did not die. He learned from there that there were several varieties and he thought we had been supplied from the gardens with the wrong variety. He had a goodly number of Castilloa rubber trees and they had grown splendidly and never suffered from white scale. He would now like the Department to tap the trees systematically and settle the question whether they would yield rubber in payable quantities or not.

The DIRECTOR OF AGRICULTURE—said he had been looking into the matter and found that the Castilloa plants that had been supplied here came from Kew, and were of the best variety. There was no doubt at all that they had the right sort. With regard to the tapping of the trees, the Department could send Mr Cradwick to tap them.—*Journat of the Jamaica Agricutlural Society*, November, 1909.

RUBBER GROWING IN INDO-CHINA.

Monsieur Albert Littaye, Vice-President of the Société Agricole de Suzannah, was in Colombo a few days ago on his way back to France. Regarding the progress made in para rubber cultivation in Indo-China, M. Littaye said (to the "Times of Ceylon") that there were, at present, only three rubber plantations in Indo-China, the above being the chief one. Some seven or eight years ago a French Government official, a Commissioner of Police, experimented, on his own account, with para rubber, from seed which he procured from Singapore. He kept the matter very much to himself, as he was nervous of exposing himself to ridicule in the event of failure of the product to do well. At present he has some very fine seven-year-old rubber trees on his plantation; this year had an output of three tons, which he had sold at 14 francs or 11s 6d a kilo (2 1-5 lb). For 1910 he had sold forward the crop of four tons at 20 fancs (16s) a kilo! On Suzannah estate operations were started a little over four years ago, a concession being obtained from the French Government of 2,500 hectares (one hectare=2·47 acres). They proceeded to plant a portion of it with rubber, using

RICE AS A CATCH CROP.

The original concessionaires would have had the land free of charge, had they been able to fulfill the conditions of opening up laid down by the French Government, but as they were not able to do this they had to pay for tho freehold at the rate of 25 centimes per hectare—some £25 sterling. The present Company had paid the original concessionaires 70,000 dollars (£7,000 sterling), and formed a Company with a capital of 300,000 dollars. They have since issued 300,000 dollars' worth of 10 per cent debentures —over-subscribed—redeemable in ten years or by exchange for shares in the Company. The money had all been raised in Indo-China, striking testimony to the enterprise of the French colonists. The Company has 700 trees three years and ten months old; some have circumference 40 centimetres (100 centimetres=39 inches). Of rubber trees 2 years and ten months old they had 25,000 trees; of one year and ten months old, 50,000 trees; the remainder on 250 hectares being of this year's planting. Altogether they had 500 hectares planted in rubber, and their intention was to plant up until they had 200,000 trees well-grown. The planting is done *in quincunx* —four trees forming a square with the fifth in the centre—the distance apart being five metres. They consider that the land is very suitable for rubber cultivation, and are thoroughly satisfied with the present growth obtained. The Suzannah Company land has been specially selected for its suitability, and is situated some 64 kilometres (one kilometre = $\frac{5}{8}$ of a mile) from Saigon, the estate being situated right on the railway line from Saigon, the Railway station Dangiay being on the estate, M. Littaye says he and his fellow Directors find Rice growing very helpful, as it enables the plantation to be kept free from weeds and provides food for the labour force, Silk cultivation is also pursued. At present they have a force of 300 coolies on the estate. These are Annamites and, being an agricultural people, they take very kindly to the work on the estate. The country, of course, is very sparsely populated, due to the endless wars before the French occupation; but no difficulty is anticipated in obtaining an adequate supply of labour.

HIGH WAGES.

The rate of wages paid to the present force is a good deal higher than is paid in the Middle East—40 dollar cents or one franc *per diem,* plus rice. M. Littaye thinks, however, that labour will increase as time goes on, and be obtainable at cheaper rates than those prevailing. The estate is situated about 100 metres above sea level, and has several small streams running through it. In the matter of rainfall, the country has a wet season of eight months and a dry season of four months. The President of the Company, is M, Thiollier. M. Littaye and M. Guarriguene being vice-Presidents. The Superintendent is a Frenchman named M. Girard, who had no previous experience of Rubber planting, but who may visit the Malay States early next year, and take back with him expert tappers to instruc the Annamite coolies.

RUBBER IN EAST JAVA.

Supplanting Coffee.

The *Java Bode* calls attention to the fact that, in East Java, coffee estates are being steadily bought up on British account for rubber cultivation. For instance, the Glunsing estate in the province of Pasaruan, (about 540 acres in extent) which, for many years had been worked at a loss, has passed into British hands for that purpose.

RUBBER NEWS FROM BRAZIL.

The "Brazilian Review" has some very pertinent remarks about the wild rubber industry in its issue of the 16th November. It is not easy, apparently, for foreigners to learn the ropes, and English companies formed to collect rubber in Brazil almost invariably end in failure. They pay too much for their property to begin with, and the men they send out, generally without any experience of the very peculiar conditions ruling in the Amazon, are robbed and victimised on every hand. Even if they collect a little rubber, it is, according to your contemporary, at enormous cost, and they are lucky if half of it is not stolen before it gets to market. As regards future competition between plantation rubber and wild Para, the "Brazilian Review" has no doubt as to which will succumb. "50 per cent. of the rubber shipped on the Amazon is," it says, "of inferior kinds which obtain only 60 per cent. of the price of fine hard Para.' It is this inferior rubber that will suffer and go to the wall when the East produces 30,000 or 50,000 tons per annum, all of as high quality as Para fine. The halcyon days of wild rubber are numbered." As for planting in Brazil, the same paper says that no foreign capital is likely to be invested on a large scale so long as export duties of 20 per cent. such as now rule on the Amazon are maintained, whereas in British Colonies, where labour is much more abundant and cheaper, there are no export duties whatever. [The writer forgets the Straits, though the export duty there is very small.—A. M. & J. F.] Under such circumstances, competition by Brazil will soon be impossible for every kind of rubber except the finest grades.

It must also be remembered that though there are undoubtedly very valuable tracts of rubber-producing land to be found in the various tropical South American States, the great drawback to them is their inaccessibility and the want of sufficient and reliable labour for their successful exploitation. The land laws of the South American States are exceedingly complex, and the difficulty of obtaining indefeasible titles for land in those States, particularly as regards forest or rubber land, is often almost unsurmountable.

No less than 2,863 tons of rubber, worth £1,380,000, were shipped from Brazilian ports in the last twenty-one days of October, and this no doubt accounts to some extent for the recent fall in price. Heavy supplies were also expected during November and December.—Georgos in *Madras Mail*, Jan. 5.

GOVERNMENT AID TO RUBBER PLANTERS IN BRAZIL.

We have received a communication from a friend in Brazil from which it appears that the Brazilian Federal Government is about to make a move in favour of

SYSTEMATIC PLANTING

of rubber. It is proposed to offer those who will undertake to plant a million trees or so, free land and total exemption from duties on exports of rubber for a long term of years, with possible participation by Government in profits. As the only territory where the Federal Government is supreme is the Acre (the rest of the country being under the immediate control of the State Governments) the experiment will be made there. The soil and climate of the

ACRE TERRITORY

are reputed to be the best possible for rubber, and the former improves very much under cultivation. Cacao is also indigenous and grows well. This departure will, according to our correspondent, come off early in 1910 after the Budget is voted; the business will be thrown open to tender and the best terms accepted. Little surprise will, we think, be felt at this new development; it must be borne in mind that trees planted next year will not come into bearing until after 600,000 acres are producing in the East. Labour will also severely handicap planting enterprises in Acre.—*India Rubber Journal*, Dec. 13.

AGRICULTURE IN NYASALAND.

Mr. S. Simpson, formerly Senior Lecturer on Agriculture at the Government Agricultural College, Egypt, read a paper on "The Agricultural Development of Nyasaland" before the Colonial section, Society of Arts, John Street, Adelphi, yesterday. Sir H. Johnston presided.

Mr Simpson—said that real progress had been made in Nyasaland, especially in the last three years. Natives were becoming accustomed to work for longer periods than formerly and

LABOUR WAS BOTH PLENTIFUL AND WILLING,

though not very efficient. The questions of transport had been a great barrier to progress, but now it was possible to get the main crops from Blantyre to London or Liverpool for ½d. a pound by sending them to Port Herald by the Shire Highlands Railway. There was too much transshipment before the ocean steamer was reached, and the transport problem could never be really solved until there was railway communication with the sea coast at Beira. Coffee was an easy crop to manage, and in the right soil it gave a steady return in spite of low prices.

COTTON

growing was now a firmly established industry, the area devoted to cotton cultivation would gradually increase. The latest reports stated that the crops were excellent, and the quality was such that it was quoted at 2d. to 2½d. above middling American; in fact, the quality appeared to be better than was produced by American Upland seed anywhere else in the world.

TOBACCO

had become an established product of the country, and now the Imperial Tobacco Company had decided to come into the country and had opened a buying factory there. From a value in tobacco exported in 1900 of £113, they had grown to an export amounting to £14,252 in 1909. The planting of exotic rubber-producing trees was making progress throughout the Protectorate, and the acreage under cultivation was rapidly increasing. Live stock generally had not received the attention which it deserved. The country could also produce a useful and valuable class of timber.

The Chairman—in moving a vote of thanks, said that for cotton growing Nyasaland was undoubtedly well suited.—London *Times*, Dec. 1.

TEA IN NATAL.

The cultivation of both sugar and tea is steadily progressing in Natal. The attractions are great, for a large market is noar at hand. There are now upwards of 5,000 acres in the Colony under tea, for the growth of which the climate of Natal is said to be admirably suited. The average return is said to be 600 lb. of dried leaf per acre, which corresponds to the yield of Ceylon. It is not so freely used in South Africa as is the Colonial sugar, because the dealers can make a larger profit on the imported tea. Most of the Natal tea crop is sent to London, where it is used for blending purposes. —*Grocers' Journal*, Dec. 18.

PLANTING IN ANGOLA.

The following information is from the report by H.M. Consul at Loanda (Mr H G Mackie) on the trade of Angola in 1908, which will shortly be issued :—

Kapok.

Kapok grows in abundance at Icolo e Bengo, Golungo Alto, Cazengo, along the banks of the River Lucalla and in many other places in tho district of Loanda. The natives, who are ignorant of its market value, do not collect it, but endeavours have been made from time to time to obtain small quantities for shipment to Europe. A trial consignment was accordingly made to a firm in the United Kingdom last year, but it did not turn out to be satisfactory because the product could not be cleaned and prepared in a suitable form for the market owing to there being no machines in Angola for removing the kapok cotton seeds from the fibre. Cleaning by hand entails too much labour to compensate tho native for his trouble; but if labour-saving machines were used, the industry might admit of development.

Proposed Government Fibre-Extracting Station.

It appears to be the intention of the Government to erect a station at Lunuango, on the Congo River, for fibre-extracting by machinery, for which the home Government has voted £400. It is proposed to extract the fibres of the *Sansevieria cytindrica* (bowstring hemp), which grows in a wild state and covers extensive areas close to the coast. The average length of the leaf of the *Sansevieria cylindrica* is stated to be about 6½ feet. Samples of the fibre have been sent to Hamburg and the prices offered were equal to those of sisal hemp.

Experiments with Caravonica Cotton.

In view of the dearth of labour in Angola the local planters have been endeavouring to grow perennial varieties of cotton. With this object in view the Governor-General recently invited the originator of a cotton treo, known under the name of Caravonica, [that is, Dr. Thomatis.—A.M.& J.F.] to visit Angola after inspecting the cotton fields of German South-West Africa. It is claimed that this species of cotton, while being superior to the American and Egyptian varieties, does not require resowing for 20 years. The originator of the species has pronounced Angola to be well adapted for cotton growing, and several local firms have entered into contracts with him. It has been agreed that, in return for the gratuitous supply of seeds of the Caravonica cotton to the extent of a little over a pound for every acre planted, all the cotton produced in Angola for a period of 10 years shall be shipped to Bremen, where it will be sold at the market price of the day, and the amount credited to the shipper after deduction of a commission of 10 per cent. Should the trials now being made prove as satisfactory as is expected, Caravonica cotton will quickly supersede all the othor varieties grown in Angola.—*Board of Trade Journat*, Dec. 16.

THE MANURING OF CACAO.

The following is taken from the seventh of a series of articles by J H Hart, F.L.S., on Cacao, which are appearing in the *West India Committee Circular*. Reference to these articles has been made already on pages 260 and 292 of the present volume of the *W.I. Agricultural News*:—

The application of manure is a subject upon which chemists and vegetable physiologists differ in many respects. The chemist is apt to insist upon the manure being buried beneath the soil, or, he says, much of its value will be lost owing to the dispersion of its volatile properties by moving air ; but the cultivator may easily ascertain the best method of applying manures of all kinds, if he studies the life history and character of the plant, and the nature and morphology of its organs of assimilation ; and moreover, the frequent showers of the tropics prevent any great waste of the volatile constituents, unless they come so heavy as to wash them away.

The destruction of roots which the operation of burying manure occasions, would, in most instances, completely nullify the action of the manure applied, as the broken roots would not have the power, or the same amount of surface for absorbing food, as when uninjured ; and the manure applied, through its coming into direct contact with injured tissue, would tend to destroy the roots by its caustic character, rather than to be absorbed by them. That beneficial results follow the application of manure when buried beneath the surface, is, of course, patent to the novice, but in the case of surface-feeding plants, it is only after the roots have recovered from the injuries done by the digging, that they are able to take up any manure which has been applied when these organs are again in a condition to perform their proper functions. Even granting that no special harm is done to the trees, there is inevitable delay in economy of growth, the hazard of losing a flowering season and consequent loss of crop.

With deep-rooting plants the burial of manure is the most economical method of application, as there can be no loss of volatile constituents.

If we think over for a while the course which Nature has pursued for ages in supplying plants with their food, we shall find that the method

adopted is purely surface manuring, and this method, with not a few modifications, is generally being adopted in what are called Orchard Cultures. Even the ground the plant grows on, has been almost entirely formed, by additions to its surface, by detritus from surrounding lands by deposits made by flood waters, or by decay induced by the flow of water over its surface, carrying with it solvents which are able to disintegrate the materials of which it is composed. For tree cultivation, surface-manuring is the only method in which the manure can be fully utilised; and we can easily take steps to guard against evaporation or dispersion of volatile principles, by covering the manure with material which will act as an absorbent and thus retain the constituents likely to escape.

In practice, the covering of the ground with fresh or decaying vegetable material is known as 'mulching', and it has been proved that for cacao the practice is of the greatest value.

Dr. Francis Watt, C.M.G., Imperial Commissioner of Agriculture for the West Indies, in reporting on experiments in Dominica, has the following, with reference to 5 experiment plots of cacao: 'The most interesting plot is the one mulched with grass and leaves, sweepings of the lawn at the Botanic Station. In the first period, this plot, though giving a greater yield than the no-manure plot, fell far behind the plot receiving dried blood, or the plot receiving complete manure, viz., dried blood, phosphate and potash (2 A) and that receiving dried blood with phosphate and potash (4 E). The yield was practically identical with that from the plot receiving dried blood alone (3 B). In the third year, this plot far surpassed all the others, giving yields 66 per cent greater than that obtained from the no-manure plot.'

In the Botanical Department, Trinidad, for many past years, mulching has been taught as a valuable method for orchard culture of cacao and other products, and in Vol. V, *Botanical Bulletin*, Trinidad, 1902-3, the following beneficial effects are recorded, viz., that mulching :—

(1) Keeps down weeds.

(2) Prevents evaporation, and keeps ground moist.

(3) Furnishes suitable manure in gradual supplies.

(4) Attracts earth worms to the surface, and causes them to cut numerous burrows, which aërate and cultivate the soil; in fact the worms actually manure it by carrying down into the tunnels the decomposed organic matter.

By the use of 'mulching,' it is certain that cacao can be grown successfully on lands that could not produce it otherwise; and on some of the large estates the practice is being adopted, especially on those fields which suffer during the dry season.

The cacao tree, although it likes a deep, rich soil, is also a surface-feeding plant, and the ground round the trees cannot be dug or forked with impunity, for, although the tree will stand considerable hardship, it is nevertheless materially injured when the roots are mutilated. There are conditions, however, such as when the surface soil has been thoroughly baked by drought, when it would be beneficial to lightly prick it up with a fork, taking care not to break the roots (vertical forking). A slight forking is, however, permissible at times, previous to applying farmyard manure upon the surface, having due regard, of course, to what has been said in the foregoing remarks on the injury caused by the injudicious use of fork and spade. Manure applied to the surface should be covered, if possible, with a thin layer of earth; but if applied in the form of compost, this is not so necessary an operation, as the volatile constituents of the manure are then in a great measure held fast.

In applying chemical manures of a caustic character, it is always well to mix them with a suitable proportion of absorbent earth, and to cover again with a coating of the same material. The primary object in applying manure is to maintain a due proportion of plant food when land has become exhausted of its natural constituents, or to supply something in which the land is deficient. It is of course patent that, with the continued production of annual crops, a large quantity of material is removed from the soil; and this must be replaced, whether by Nature or artificially, or the crop will fall short. Farmyard manure takes a foremost position for this purpose among all others, and long-continued practice shows that, when properly applied, it is of the greatest value to the land, not only for its manurial properties, but also for its mechanical action upon the soil; and moreover, it can never be as dangerous to use as chemical manures, which are admitted to be decidedly hazardous when applied by unskilled labour.—*W. Indian Agricultural News*, Oct. 30.

VISIT OF A SARAWAK PLANTER TO CEYLON.

Mr E Hose, a planter in the service of the Borneo Company Ltd., Sarawak, has spent a fortnight in Ceylon and leaves by the German steamer for the East. Mr Hose has spent 17 years in Sarawak and is manager of the rubber and gambier estates of the Company at Poak and of its extensive Sungei Tengah rubber estates, Mr Hose has some 3000 acres of rubber, on which tapping will commence early in 1910; in Ceylon he took the opportunity of acquainting himself with the up-to-date methods employed in the extraction and preparation of latex in Ceylon. Among the estates visited for this purpose were Culloden, and Kondesale, while Mr Hose also had an enjoyable visit to Kirkoswald tea estate. Mr Hose met Mr Bamber in Sarawak two years ago and renewed acquaintance with him at Peradeniya the other day where he was shown much to interest and educate him. In conversation with a representative of the *Observer* today Mr Hose remarked that as far as he could ascertain it at home, the feeling in rubber circles was that the price of rubber would decline considerably towards the end of the year; but later on would rise to a figure higher than it had yet attained. It was generally thought these "fictitious" prices would continue, more or less two years more.—*Ceylon Observer*, Dec. 18.